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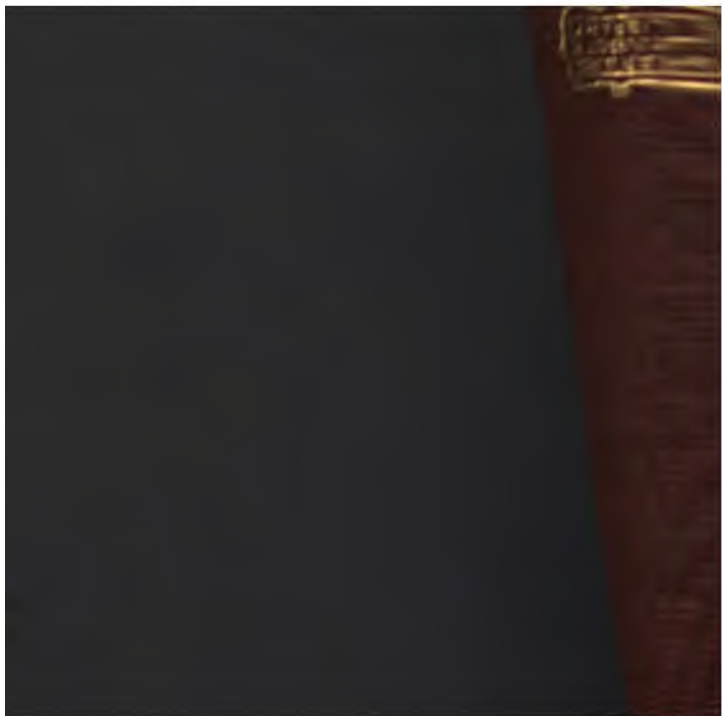
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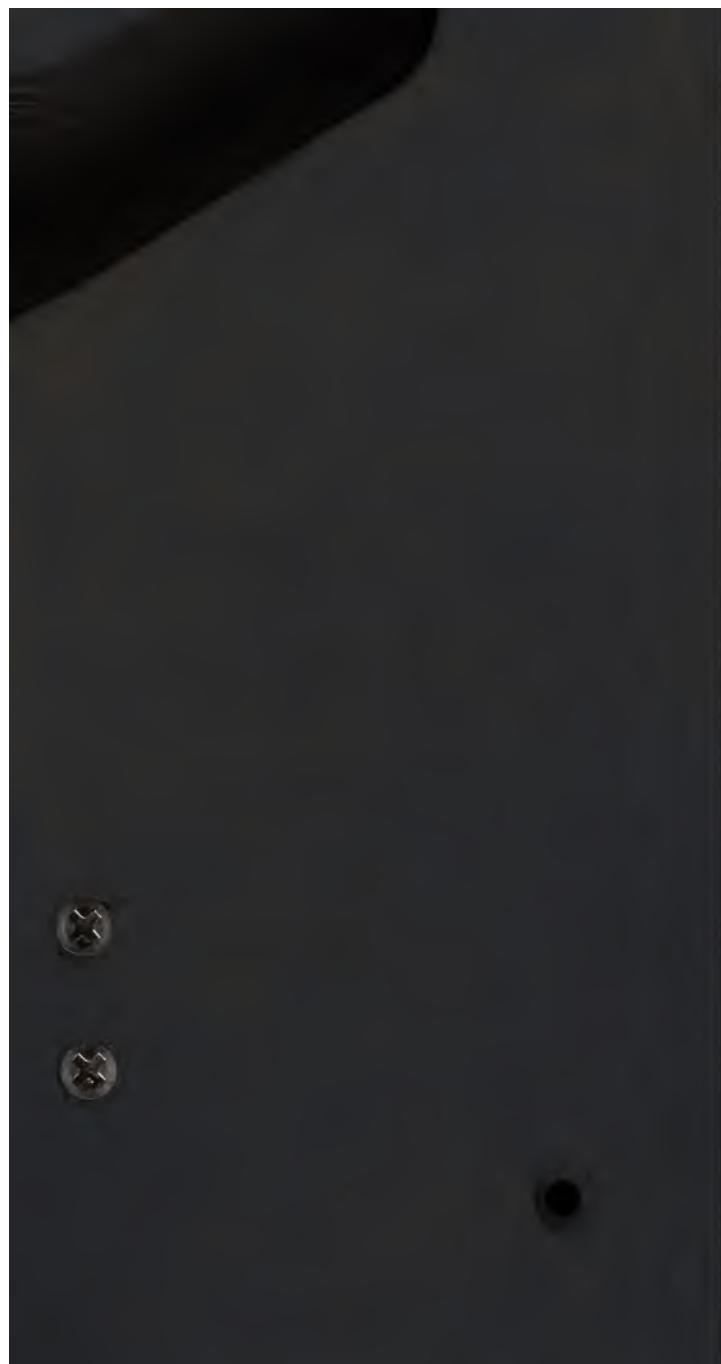
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ARITHMETIC







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THE
NATIONAL ARITHMETIC,

COMBINING THE
ANALYTIC AND SYNTHETIC METHODS,

IN WHICH THE PRINCIPLES OF ARITHMETIC ARE EXPLAINED
IN A PERSPICUOUS AND FAMILIAR MANNER; CONTAINING
ALSO, PRACTICAL SYSTEMS OF MENSURATION,
GAUGING, GEOMETRY, AND

BOOK-KEEPING,

FORMING A COMPLETE
MERCANTILE ARITHMETIC,

DESIGNED FOR SCHOOLS AND ACADEMIES.

BY BENJAMIN GREENLEAF, A. M.
Preceptor of Bradford Academy.

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AND
GOULD, KENDALL AND LINCOLN.

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1836.

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Entered, according to Act of Congress, in the year 1835,

BY BENJAMIN GREENLEAF,

In the Clerk's office of the District Court of Massachusetts.

CHARACTERS USED IN THIS WORK.

- = Sign of equality; as $12 \text{ inches} = 1 \text{ foot}$, signifies, that 12 inches are equal to one foot.
- + Sign of addition; as $8 + 6 = 14$ signifies, that 8 added to 6 is equal to 14.
- Sign of subtraction; as $8 - 6 = 2$, that is, 8 less 6 is equal to 2.
- × Signs of multiplication; as $7 \times 6 = 42$, that is, 7 multiplied by 6, is equal to 42.
- ÷ Sign of division; as $42 \div 6 = 7$, that is, 42 divided by 6 is equal to 7.
- $\frac{7}{2}$ Numbers placed in this manner imply, that the *upper* line is to be divided by the *lower* line.
- : : : Signs of proportion; thus, $2 : 4 :: 6 : 12$, that is, 2 has the same ratio to 4, that 6 has to 12; and such numbers are called *proportionals*.
- $12 - 3 + 4 = 13$. Numbers placed in this manner show, that 3 is to be taken from 12, and 4 added to the remainder. The line at the top is called a *vinculum*, and connects all the numbers over which it is drawn.
- 9^2 Implies, that 9 is to be raised to the second power; that is, multiplied by itself.
- 8^3 Implies, that 8 is to be multiplied into its square.
- ✓ This sign prefixed to any number shows, that the square root is to be extracted.
- $^3\checkmark$ This sign prefixed to a number, shows, that the cube root is to be extracted.

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ARITHMETIC.

ARITHMETIC is the art of computing by numbers. Its five principal rules are Numeration, Addition, Subtraction, Multiplication, and Division.

NUMERATION.

Numeration teaches to express the value of numbers either by words or characters.

The numbers in Arithmetic are expressed by the following ten characters, or Arabic numeral figures, which the Moors introduced into Europe about nine hundred years ago; viz. 1 one, 2 two, 3 three, 4 four, 5 five, 6 six, 7 seven, 8 eight, 9 nine, 0 cipher, or nothing.

The first nine are called *significant figures*, as distinguished from the cipher, which is of itself insignificant.

Besides this value of those figures, they have also another, which depends on the place in which they stand, when connected together; as in the following table.

| Hundreds of Millions. | Tens of Millions. | Millions. | Hundreds of Thousands. | Tens of Thousands. | Thousands. | Hundreds. | Tens. | Units. |
|-----------------------|-------------------|-----------|------------------------|--------------------|------------|-----------|-------|--------|
| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 |
| | | 9 | 8 | 7 | 6 | 5 | 4 | 3 |
| | | | 9 | 8 | 7 | 6 | 5 | 4 |
| | | | | 9 | 8 | 7 | 6 | 5 |
| | | | | | 9 | 8 | 7 | 6 |
| | | | | | | 9 | 8 | 7 |
| | | | | | | | 9 | 8 |
| | | | | | | | | 9 |

Here any figure in the first place, reckoning from right to left, denotes only its simple value; but that in the second place, denotes ten times its simple value; and that in the third place a hundred times its simple value; and so on; the value of any successive place being always ten times its former value.

Thus in the number 1834, the 4 in the first place denotes only four units, or simply 4; 3 in the second place signifies three tens, or thirty; 8 in the third place signifies eight tens or eighty; and the 1, in the fourth place, one thousand; so that the whole number is read thus,—one thousand eight hundred and thirty-four.

As to the cipher, 0, though it signify nothing of itself, yet being joined to the right hand of other figures, it increases their value in a tenfold proportion; thus 5 signifies only five, but 50 denotes 5 tens or fifty; 500 is five hundred; and so on.

NUMERATION TABLE.

| | |
|--|----------------|
| 317,897,431,032,639,864,361,316,461,315,123,675,816,131,123,456,123,614,315,131,398,832,563,871,351,615,123,561. | Thousands. |
| | Tredecillions. |
| | Thousands. |
| | Duodecillions. |
| | Thousands. |
| | Undecillions. |
| | Thousands. |
| | Decillions. |
| | Thousands. |
| | Nonillions. |
| | Thousands. |
| | Octillions. |
| | Thousands. |
| | Septillions. |
| | Thousands. |
| | Sextillions. |
| | Thousands. |
| | Quintillions. |
| | Thousands. |
| | Quatrillions. |
| | Thousands. |
| | Trillions. |
| | Thousands. |
| | Billions. |
| | Thousands. |
| | Millions. |
| | Thousands. |
| | Units. |

In order to enumerate any number of figures, they must be separated by semicolons into *divisions* of six figures each, and each division by a comma, as in the annexed table. Each division will be known by a different *name*. The first three figures in each division will be so many thousands of that name, and the next three will be so many of *that* name, that is over its unit place. The value of the numbers in the annexed table, expressed in words, is Three hundred and seventeen thousand, eight hundred and ninety seven tredecillions; four hundred and thirty-one thousand, thirty-two duodecillions; six hundred thirty-nine thousand, eight hundred sixty-four undecillions; three hundred sixty-one thousand, three hundred sixteen decillions; four hundred sixty one thousand, three hundred fifteen nonillions; one hundred twenty-three thousand, six hundred seventy-five octillions; eight hundred sixteen thousand, one hundred thirty-one septillions; one hundred twenty-three thousand, four hundred fifty-six sextillions; one hundred twenty-three thousand, six hundred fourteen quintillions; three hundred fifteen thousand, one hundred thirty-one quatrillions; three hundred ninety-eight thousand, eight hundred thirty-two trillions; five hundred sixty-three thousand, eight hundred seventy-one billions; three hundred fifty-one thousand, six hundred fifteen millions; one hundred twenty-three thousand five hundred sixty-one.

NOTE.—The student must be familiar with the names, from Units to Tredecillions, and from Tredecillions to Units, so that he may repeat them with facility either way.

The following Table is the French method of Enumeration.

| | | |
|---|----------------|---|
| 809,317,123,566,315,861,831,561,786,811,123,617,831,515 | Tridecillions. | By the annexed table it will be seen, that every three figures have a different name. |
| | Duodecillions. | Their value would be expressed thus:— |
| | Undecillions. | Eight hundred nine tredecillions, three hundred and seventeen duodecillions, one |
| | Decillions. | hundred twenty-three undecillions, five |
| | Nonillions. | hundred eighty-six decillions, three hundred |
| | Octillions. | fifteen nonillions, eight hundred sixty-one |
| | Septillions. | octillions, eight hundred thirty-one septil- |
| | Sextillions. | lions, five hundred sixty-one sextillions, sev- |
| | Quintillions. | en hundred eighty-six quintillions, eight |
| | Quatrillions. | hundred eleven quatrillions, one hundred |
| | Trillions. | twenty-three trillions, six hundred seven- |
| | Millions. | teen millions, eight hundred thirty-one |
| | Thousands. | thousand, five hundred and fifteen. |
| | Units. | |

NOTE.—It is very doubtful, whether the French method is so good as that of the English.

Let the following numbers be written in words.

| | |
|--|---|
| | 76 |
| | 319 |
| | 74,679 |
| | 864,093 |
| | 27,623,781 |
| | 367,832,732,567 |
| | 216,746,230,095,623 |
| | 56,000,000,602,007,020 |
| | 7,065,182,347,627,907,640 |
| | 802,678,327,006,279,206,040 |
| | 6,070,360,217,642,176,400,567 |
| | 4,332,705,607,204,062,376,407,592 |
| | 3,469,200,000,000,111,111,100,000,001,101 |
| | 7,006,437,576,589,081,828,384,859,091,929,394,332 |
| | 71,326,436,035,769,846,012,131,415,161,718,192,021,223 |
| | 712,642,976,403,796,411,604,220,404,263,575,068,076,001 |
| | 170,907,642,376,756,809,000,604,020,760,307,000,100,000 |

Let the following numbers be written in figures.

1. Twenty-nine.
2. Four hundred and seven.
3. Twenty-three thousand and twenty-seven.
4. Five million two thousand and five.
5. Seventeen trillion two hundred million and six.
6. Fifteen billions twenty-seven thousand million nine thousand two hundred and five.
7. Seven billions, five millions, six thousand, five hundred and twenty-five.
8. Ninety-nine trillions, seventy-nine thousand six hundred billions, one hundred and twenty-four millions, three hundred and twenty-nine.
9. Fifteen quintillions, thirty-three thousand millions, seventy-six thousand and five.
10. Eight thousand five hundred and forty-three septillions, five quintillions, seven hundred twenty-nine thousand three hundred and forty-six quadrillions, three hundred fifty seven thousand two hundred sixty-one trillions, four hundred and two thousand, twenty-three billions, seven millions and forty-six.
11. Nine nonillions, forty-seven trillions, ten thousand seven billions, two million and seventy-two.
12. Three hundred and twenty thousand and fifteen duodecillions, two thousand and ten trillions, one hundred and twenty-seven billions, twenty-six millions, three hundred and twenty thousand four hundred and twenty-six.

MENTAL OPERATIONS IN ADDITION.

1. How many are 3 and 4? How many are 3 and 6? How many are 3 and 7? How many are 9, 7 and 3? 4 and 10? 7 and 6? 5 and 11? 3 and 15? 6 and 5? 4 and 8? 10 and 5? 3 and 12? 6 and 6? 6 and 8? 6 and 7? 6 and 3? 6 and 10? 6 and 9? 6 and 12? 6 and 11? 6 and 13? 5 and 3? 5 and 5? 5 and 4? 5 and 7? 5 and 9? 5 and 8? 5 and 6? 5 and 12? 5 and 15? 5 and 13? 7 and 3? 7 and 5? 7 and 7? 7 and 9? 7 and 8? 8 and 2? 8 and 5? 8 and 4? 8 and 8? 8 and 7? 8 and 9? 8 and 12? 8 and 10? 9 and 5? 9 and 2? 9 and 4? 9 and 9? 9 and 7? 9 and 8? 10 and 5? 10 and 7? 10 and 4? 10 and 3? 10 and 10?

2. Bought an orange for 3 cents and some nuts for 6 cents; what did they both cost?

3. Bought a pound of figs for 8 cents and a pint of cherries for 7 cents; what was the price of both?

4. Bought a book for 12 cents and some paper for 9 cents; what did they both cost?

5. Gave 6 dollars for a cow and 9 dollars for a load of hay; what did I give for both?

6. A boy gave 12 cents for a penknife and 10 cents for a bunch of quills; what did he give for both?

7. A boy gave 8 cents for a top and 9 cents for some apples; what was the price of the whole?

8. A lady gave 11 dollars for a silk cloak and 7 dollars for a bonnet; what was the price of both?

9. How many are 3 and 2 and 5? How many are 7 and 8 and 10? How many are 11 and 5 and 2? 6 and 5 and 4? 7 and 5 and 8? 12 and 3 and 9? 15 and 2 and 3? 16 and 3 and 4? 10 and 9 and 3? 12 and 5 and 2? 13 and 10 and 2? 15 and 5 and 10? 25 and 2 and 3? 30 and 2 and 8? 1 and 50 and 2? 50 and 50 and 1? 12 and 12 and 10? 13 and 7 and 5? 30 and 20 and 10? 10 and 60 and 30? 15 and 5 and 50? 100 and 50 and 60? 17 and 9 and 7? 19 and 9 and 8? 99 and 6 and 10? 29 and 8 and 8? 15 and 15 and 15?

10. James gave 30 cents for an arithmetic, 10 cents for a slate, and 15 cents for a writing book; what did he give for the whole?

11. A merchant has due from one creditor 20 dollars, from another 10 from another 25. What is the sum due from the whole?

12. A gentleman gave 17 dollars for a coat, 12 dollars for pantaloons, 5 dollars for a vest, 6 dollars for a hat. What did they all cost him?

13. A drover has three flocks of sheep; the first has 25, the second 35, and the third 50. How many in the whole?

14. William is 12 years old, John is 9, and Thomas is 8. What is the sum of their ages?

15. Samuel has 5 apples, Enoch has 18, and Levi has 20. How many in the whole?

16. A beggar received of one man 14 cents, of another 12, of another 8, and of another 7. How many has he received?

17. Samuel has 12 marbles in one pocket, 12 in another, and 2 in each hand; how many has he in all?

18. John has 7 birds in one cage, and 12 in another; how many has he in both cages?

19. A farmer has 11 calves in one pasture, 6 in another, and 5 in another; how many has he in the whole?

20. Thomas caught one afternoon 7 pickerel, 9 trout, and 10 perch; how many had he in all?

21. A boy at service earned the first week 9 shillings, the second week 11 shillings, and the third week 12 shillings; how much money had he?

22. A lady gave 15 dollars for a bonnet, 20 dollars for a silk dress, and 12 dollars for other articles; what was the amount of her bill.

23. In one school room are 30 scholars, in another 20, and in another 50; how many in all?

24. My shoes cost me 2 dollars, my books 5, my hat 5, my cloak 20, and my other garments 10; what are they all worth?

25. The distance from Bradford to Salem is 22 miles, from Salem to Marblehead 4 miles; what is the whole distance?

26. From Lowell to Haverhill is 20 miles, from Haverhill to Newburyport is 14 miles; what is the whole distance?

27. A boy has 15 cents in each of his two pockets, and 5 in each hand; how many has he?

28. A girl gave 17 cents for cherries, 5 for apples, and 7 for peaches; what did they all cost?

29. A man gave 11 dollars for a plough, 15 dollars for a cart, 5 dollars for a wheelbarrow, and 10 dollars for a wagon; what did they all cost?

30. A butcher gave 12 dollars for an ox, 9 dollars for a cow, and 7 dollars for three pigs; what did they all cost?

31. A farmer has 25 apple-trees, 10 pear trees, and 15 peach trees; how many in all?

32. A merchant receives 18 barrels of flour by one vessel, 12 by another, and 12 by another; how many has he?

33. A boy at one time lost 7 marbles, at another 5, at another 8, at another 12; how many has he lost?

34. Thomas gave 17 cents for a whip, 13 cents for a top, 12 for a knife, and 10 for marbles; how much did he lay out?

35. Gave 60 dollars for a horse, 30 for a wagon; what did they both cost?

36. A boy at a Sabbath school committed at one lesson 25 verses, at another 15 verses, at another 20 verses; how many did he commit in all?

37. I owe a merchant 7 dollars for sugar, 5 dollars for coffee, 17 for flour, 3 dollars for tea, and 2 dollars for salt; what is the whole sum due?

38. A laborer worked 9 days for one man, 11 days for another, 7 for another, 6 for another, 10 for another, and 3 for another; how many days has he labored?

ADDITION.

ADDITION is the collecting of several numbers together in order to find their sum.

RULE.

Place the numbers under each other, so that each figure may stand directly under the figures of the same value. Then add the figures in the column of units, and find how many tens are contained in that sum. Set down directly below what remains more than those tens; or, if nothing remains, set down a cipher, and carry as many units to the next row, as there are tens. Then add up the second row together with the number carried, in the same manner, as before. Proceed in this way until the whole is finished, setting down the total amount in the last row.

PROOF.

Begin at the top, and add together all the rows of numbers *downwards*, in the same manner, as they were before added *upwards*; then if the two sums agree, it may be presumed the work is right.

EXAMPLES.

| 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|-------|-----|------|-------|--------|---------|--------|
| 1 | 12 | 123 | 98765 | 367856 | 1234567 | 678123 |
| 2 | 23 | 456 | 32145 | 789123 | 8912345 | 456789 |
| 3 | 34 | 789 | 67811 | 478956 | 7856627 | 567128 |
| 4 | 61 | 234 | 21346 | 367123 | 4478536 | 889998 |
| 5 | 32 | 567 | 12389 | 678910 | 7813791 | 123456 |
| 6 | 58 | 890 | 99678 | 123456 | 8951372 | 789138 |
| 7 | 96 | 345 | 12345 | 895567 | 3467854 | 767799 |
| 8 | 89 | 678 | 78912 | 347890 | 9514673 | 135798 |
| 9 | 32 | 357 | 34567 | 643634 | 1234578 | 765432 |
| <hr/> | | | | | | |
| 45 | 437 | 4439 | | | | |

8. Add the following numbers together, 763, 4663, 37, 49763, 6178, and 671. Ans. 62075.

9. A butcher sold to A 369 lbs. of beef, to B 169 lbs., to C 861 lbs., to D 901 lbs., to E 71 lbs., and to F 8716 lbs.; what did they all receive? Ans. 11087 lbs.

10. A owes to one creditor 596 dollars, to another 3961, to another 581, to another 6116, to another 469, to another 506, to another 69381, and to another 1261. What does he owe them all? Ans. 82871 dols.

11. If a boy earn 17 cents a day, how much will he earn in a week? Ans. 119 cts.

12. If a man's wages be 19 dollars per month, what are they per year? Ans. 228 dols.

13. If a boy receive a present every new year's day of 1783 dollars, how much money will he possess, when he is 21 years old? Ans. 37443 dols.

14. How many inhabitants are there in Essex county? Haverhill having 3912, Bradford 1856, Methuen 2011, Andover 4540, Boxford 937, Newburyport, 6338, Newbury 3603, West Newbury 1586, Rowley 2044, Ipswich 2951, Danvers 4228, Essex 1345, Topsfield 1011, Lynn 6138, Saugus 960, Middleton 607, Marblehead 5150, Salem 13886, Lynnfield 617, Gloucester 7513, Beverly 4079, Hamilton 743, Wenham 612, Salisbury 2519, Manchester 1238, and Amesbury 2445.

Ans. 82869.

15. Of how many members does the British House of Commons consist? England sending county members, 143; Isle of Wight, 1; universities, 4; cities, boroughs, and cinque ports, 323; Wales, county members, 15; boroughs, 14; Scotland, county members, 30; cities and boroughs, 23; Ireland, county members, 64; university, 2; cities and boroughs, 30?

Ans. 649.

16. How many are the members of Congress? There being 2 senators from each state; and New Hampshire sending 5, representatives; Massachusetts 12, Maine 8, Connecticut 6, Rhode Island 2, Vermont 5, New York, 40, New Jersey 6, Pennsylvania 28, Delaware 1, Maryland 8, North Carolina, 13, South Carolina 9, Georgia 9, Kentucky 13, Tennessee 13, Ohio 19, Alabama 5, Mississippi 2, Missouri 2, Illinois 3, Virginia 21, Louisiana 3, Indiana 7.

Ans. 288.

17. According to the census of 1830, Maine had 399437 inhabitants, New Hampshire 269367; Massachusetts 610014; Connecticut 297513; Rhode Island 97210; Vermont 280679;

New York 1913508; New Jersey 320779; Pennsylvania 1347672; Delaware 76739; Maryland 446913; Virginia 1211272; North Carolina 738470; South Carolina 581458; Georgia 516567; Ohio 937679; Kentucky 688844; Indiana 341582; Illinois 157575; Missouri 140192; Tennessee 684833; Louisiana 215762; Alabama 308997; Mississippi 136806; Florida Territory 34723; Michigan Territory 31260; Arkansas Territory 30383; District of Columbia 39858. What is the whole number of inhabitants? Ans. 12,856,092.

MENTAL OPERATIONS IN SUBTRACTION.

1. If 3 be taken from 4, how many will be left? If 2 be taken from 5, how many will be left? If 5 be taken from 9, how many will be left? What will remain, if 7 be taken from 10? 8 from 13? 7 from 11? 13 from 16? 3 from 20? 5 from 15? 10 from 19? 7 from 15? 7 from 14? 3 from 10? 4 from 12? 5 from 19? 19 from 21? 7 from 16? 7 from 19? 4 from 20? 13 from 17? 18 from 28? 3 from 27? 7 from 18? 6 from 16? 13 from 21? 16 from 19? 16 from 23? 16 from 26? 11 from 19? 13 from 19? 13 from 14? 27 from 29? 21 from 23? 12 from 17? 12 from 19? 12 from 21? 13 from 17? 14 from 19? 14 from 15? 14 from 21?

2. Sold an apple for 6 cents, and a knife for 13 cents. How much more did I receive for my knife, than for the apple?

3. Gave 7 dollars for an umbrella, and 10 dollars for a coat. How much more did the coat cost than the umbrella?

4. Bought a horse for 21 dollars, and sold it for 30 dollars. How much did I gain?

5. Bought a book for 35 cents and sold it for 25 cents. How much did I lose?

6. Bought a bunch of quills for 26 cents and sold it for 30 cents. How much did I gain?

7. Bought a chaise for 90 dollars, and a horse for 80 dollars; how much more did the chaise cost than the horse?

8. Received 25 dollars from one man and 15 dollars from another; how much more did I receive from the first than the last?

9. James has 17 nuts, he gave 6 to Benjamin; how many has he left?

10. A boy went to market with 50 cents, he gave 20 cents for butter, and 15 cents for cheese; how much has he left?

11. Fifteen black birds are on a tree, a man fired and killed 12 of them; how many were left on the tree?

12. Samuel had 20 cents, he spent 3 for raisins, and 4 for apples; how many has he left?

13. John has 15 apples, he gave 4 to Thomas, and 7 to Dick; how many has he left? and how many more has Dick than Thomas?

14. William is 17 years old, and Enoch is 9; how much older is William than Enoch? and what is the sum of their ages?

15. Mary lost 12 cents, and Jane 15 cents; how many did Jane lose more than Mary? and what did they both lose?

16. Seth has 25 nuts, he gave 4 to Abel, 5 to John, and 6 to Samuel; how many has he left?

17. If a barrel of pork is worth 15 dollars, and a barrel of beef is worth 12 dollars; how much is the pork worth more than the beef?

18. The distance from Haverhill to Boston is 30 miles, to Salem is 22; how much farther is it to Boston than Salem?

19. I have a book of 75 pages, I have read 60 of them; how many remain to be read?

20. I have a field of 48 rows of corn, I have hoed 30 of them; how many remain?

21. Benjamin has a basket of quinces, 41 in number; he gave 7 to James, 8 to Moses, and 5 to his sister; how many has he left?

22. A farmer has 18 turkeys; 3 the foxes killed, and 7 he carried to market; how many has he left?

23. Bought a whip for 50 cents, and sold it for 75 cents; what did I gain?

24. Bought a load of hay for 25 dollars, and sold it for 17 dollars; what did I lose?

25. Found 63 dollars, and lost 5 at one time, and ten at another; how many have I left?

26. James has 43 cents, and Thomas 20; James gave Thomas 3 of his; how many more has James than Thomas?

27. I wish to pay a debt of 50 dollars; John gave me 12 dollars, and Samuel gave 15; how much do I lack of having enough?

28. I have 80 cents; I wish to give 20 to Peter, 8 to John, and 5 to Luke; how many shall I have left?

29. John had 30 marbles; he lost half of them, and then gave away 5; how many had he left?

30. A farmer has 46 sheep, the wolves killed 15, and the dogs 20; how many had he left?

SIMPLE SUBTRACTION

Teaches to take one number from another of the same denomination to find the difference.

RULE.

Place the less number under the greater; units being under units, and tens under tens. Begin with the unit's place, and take the lower figure from the upper figure, and place the difference between them immediately under the unit's place; but, if the upper figure be less than the lower figure, add ten to the upper one, and place the difference between them under the unit's place as before, and carry one to the next number at the bottom, and proceed in the same manner until the question is finished.

NOTE.—The upper line is called the Minuend, and the lower one the Subtrahend. The *result* of the question is called the Remainder.

PROOF.

Add the Remainder to the Subtrahend, and if their sum be like the Minuend, the work is right.

EXAMPLE.

| 1. £ | 2. Cwt. | 3. Tons. | 4. Miles. | 5. Inches. | 6. Rods. |
|---------|------------|-------------|--------------|---------------|-------------|
| 79 | 86 | 469 | 876315123 | 11630078 | 56785111 |
| 24 | 25 | 183 | 177897638 | 1919179 | 38819566 |
| — | — | — | — | — | — |
| 55 | 61 | 286 | 698417435 | | |

⁷
Gallons.
10203400
5617851

⁸
Bushels.
100200300400500
90807060504039

⁹
Minutes.
600700800900
191818917185

¹⁰
Hours.
61567101
91678

¹¹
Dollars.
100000
1

¹²
Yards.
1000000
999999

- | | | | |
|----------|------------|------|---------|
| 13. From | 6767851 | take | 81715 |
| 14. From | 761619161 | take | 916781 |
| 15. From | 31671675 | take | 361784 |
| 16. From | 16781321 | take | 100716 |
| 17. From | 1002007000 | take | 5971621 |
| 18. From | 91611237 | take | 6718538 |
| 19. From | 4637561 | take | 4171135 |
| 20. From | 88895651 | take | 3147618 |
| 21. From | 1111111 | take | 99999 |
| 22. From | 7163878 | take | 11001 |
| 23. From | 8887771 | take | 81106 |
| 24. From | 1379156 | take | 76716 |
| 25. From | 3671652 | take | 36 |

Sum of the remainders, 2004446299.

26. Sir Isaac Newton was born in the year 1642, and he died in 1727; how old was he at the time of his decease?

Ans. 85 years.

27. Gunpowder was invented in the year 1330; how long was this before the invention of printing, which was in 1441.

Ans. 111 years.

28. The mariners' compass was invented in Europe in the year 1302; how long was this before the discovery of America by Columbus, which happened in 1492?

Ans. 190 years.

29. What number is that to which if 6956 be added, the sum will be one million?

Ans. 993044.

30. A man bought an estate for seventeen thousand five hundred and sixty-five dollars, and sold it for twenty-nine thousand three hundred and seventy-five dollars. Did he gain or lose, and how much?

Ans. 11810 dols.

31. Bought a pair of oxen for 85 dollars, a horse for 126 dollars, three cows at 25 dollars apiece; and sold the whole for three hundred dollars; how much did I gain?

Ans. 14 dols.

32. Bonaparte was declared emperor in 1804; how many years is it since?

Ans.

33. The union of the government of England and Scotland was in the year 1603; how long was it from this period to the time of the declaration of the independence of the United States?

Ans. 173 years.

34. Jerusalem was taken and destroyed by Titus in the year 70; how long was it from this period to the time of the first Crusade, which was in the year 1096.

Ans. 1026 years.

MENTAL OPERATIONS IN MULTIPLICATION.

1. What will 2 oranges cost at 3 cents a piece?
2. What will 3 apples cost at 2 cents a piece?
3. What will 7 bushels of wheat cost at 2 dollars a bushel?
4. At 6 cents a quart, what will 5 quarts of cherries cost?
5. At 4 cents a pound, what will 3 pounds of raisins cost?
6. At 9 dollars per acre, what will 8 acres of land cost?
7. At 3 shillings a bushel, what will 9 bushels of oats cost?
8. At 5 shillings a bushel, what will 9 bushels of corn cost?
9. At 8 cents per yard, what will 5 yards of cloth cost?
10. What will 10 loads of hay cost at 9 dollars a load?
11. At 8 dollars per ton, what will 12 tons of lead cost?
12. At 7 dollars per box, what will 9 boxes of lemons cost?
13. What will 12 pounds of rice cost at 7 cents per pound?
14. What will 11 pounds of sugar cost at 9 cents a pound?
15. What will 6 pounds of pepper cost at 12 cents a pound?
16. What will 9 pounds of coffee cost at 11 cents a pound?
17. What will 10 pounds of mace cost at 11 cents a pound?
18. What will 8 yards of ribbon cost at 8 cents per yard?
19. What will 8 ounces of peppermint cost at 6 cents per ounce?
20. What will 7 pair of hose cost at 3 shillings a pair?
21. What will 6 papers of pins cost at 12 cents a paper?
22. What will 11 cwt. of sugar cost at 9 dollars per hundred weight?

23. What will 7 yards of buckram cost at 12 cents per yard?
24. What will 10 oranges cost at 9 cents a piece?
25. What will 9 pair of boots cost at 4 dollars a pair?
26. What will 6 dozen of hoes cost at 11 dollars a dozen?
27. What will 15 dozen of penknives cost at 8 dollars a dozen?
28. What will 7 sheep cost at 5 dollars a piece?
29. What will 6 cwt. of copperas cost at 6 dollars a cwt.?

MULTIPLICATION.

Multiplication is a compendious way of performing Addition.

It consists of three parts, the number to be multiplied or the multiplicand, the number to multiply by, or multiplier, and the result, or product, which is the answer to the question.

RULE.

Place the larger number uppermost, and then set the multiplier under it, so that units may be under units, &c., and multiply each figure in the multiplicand by the multiplier, beginning at the unit's place and carry for ten, as in Addition. When the multiplier consists of more places than one, multiply each figure in the multiplicand by every figure in the multiplier, beginning with the units, and placing the first figure of each product directly under its multiplier; then add all these several products together in the same order as they stand, and their sum will be the true product required.

If there be ciphers at the right hand of the multiplier or multiplicand, they may be neglected in the operation, but their number must be affixed to the product.

PROOF.

The regular way to prove questions in multiplication is by Division; but a more expeditious way is by casting out the nines, thus; cast the nines from the multiplicand and place the remainder at the right of a cross, then cast the nines from the multiplier and place the remainder at the left of the cross; then cast the nines from the product and set the remainder at

the top of the cross. Multiply together the numbers on each side of the cross, and cast the nines from their product, and if the remainder be like the number at the top of the cross, it may be presumed the work is right. See Ex. 7.

MULTIPLICATION TABLE.

| | | | | | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 |
| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72 |
| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 |
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | | |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 | 126 | 132 | | |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 | 91 | 98 | 105 | 112 | 119 | 126 | 133 | 140 | 147 | 154 | | |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 | 104 | 112 | 120 | 128 | 136 | 144 | 152 | 160 | 168 | 176 | | |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 | 117 | 126 | 135 | 144 | 153 | 162 | 171 | 180 | 189 | 198 | | |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | | |
| 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 | 143 | 154 | 165 | 176 | 187 | 198 | 209 | 220 | 231 | 242 | | |
| 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 | 180 | 192 | 204 | 216 | 228 | 240 | 252 | 264 | | |
| 13 | 26 | 39 | 52 | 65 | 78 | 91 | 104 | 117 | 130 | 143 | 156 | 169 | 182 | 195 | 208 | 221 | 234 | 247 | 260 | 273 | 286 | | |
| 14 | 28 | 42 | 56 | 70 | 84 | 98 | 112 | 126 | 140 | 154 | 168 | 182 | 196 | 210 | 224 | 238 | 252 | 266 | 280 | 294 | 308 | | |
| 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | 270 | 285 | 300 | 315 | 330 | | |
| 16 | 32 | 48 | 64 | 80 | 96 | 112 | 128 | 144 | 160 | 176 | 192 | 208 | 224 | 240 | 256 | 272 | 288 | 304 | 320 | 336 | 352 | | |
| 17 | 34 | 51 | 68 | 85 | 102 | 119 | 136 | 153 | 170 | 187 | 204 | 221 | 238 | 255 | 272 | 289 | 306 | 323 | 340 | 357 | 374 | | |
| 18 | 36 | 54 | 72 | 90 | 108 | 126 | 144 | 162 | 180 | 198 | 216 | 234 | 252 | 270 | 288 | 306 | 324 | 342 | 360 | 378 | 396 | | |
| 19 | 38 | 57 | 76 | 95 | 114 | 133 | 152 | 171 | 190 | 209 | 228 | 247 | 266 | 285 | 304 | 323 | 342 | 361 | 380 | 399 | 418 | | |
| 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 400 | 420 | 440 | | |
| 21 | 42 | 63 | 84 | 105 | 126 | 147 | 168 | 189 | 210 | 231 | 252 | 273 | 294 | 315 | 336 | 357 | 378 | 399 | 420 | 441 | 462 | | |
| 22 | 44 | 66 | 88 | 110 | 132 | 154 | 176 | 198 | 220 | 242 | 264 | 286 | 308 | 330 | 352 | 374 | 396 | 418 | 440 | 462 | 484 | | |
| 23 | 46 | 69 | 92 | 115 | 138 | 161 | 174 | 207 | 230 | 253 | 276 | 299 | 322 | 345 | 368 | 391 | 414 | 437 | 460 | 483 | 506 | | |
| 24 | 48 | 72 | 96 | 120 | 144 | 168 | 182 | 216 | 240 | 264 | 288 | 312 | 336 | 360 | 384 | 408 | 432 | 456 | 480 | 504 | 528 | | |

MULTIPLICATION.

20

EXAMPLES.

| | | | |
|--------------------------------|-------------------------------|--------------------------------|--------------------------------|
| ¹ 678956324 3 | ² 36785678 7 | ³ 123456789 6 | ⁴ 987654321 9 |
| 2036868972 | 257499746 | 740740734 | 8888888880 |

| | | | |
|--|-------------------------------------|--|-------------------------|
| ⁵ 3678543 4567 | ⁶ 67854 10234 | ⁷ 612346 230049 | PROOF. 0 4×0 0 |
| 25749801 22071258 18392715 14714172 | 271416 203562 135708 67854 | 5511114 2449384 1837038 1224692 | |
| 16799905881 | 694417836 | 140869584954 | |

| | | | |
|--------------------------------|----------------------------------|-----------------------------------|-------------------------------------|
| ⁸ 678567 8007 | ⁹ 4567895 60004 | ¹⁰ 6785000 32000 | ¹¹ 478763000 12000 |
|--------------------------------|----------------------------------|-----------------------------------|-------------------------------------|

- Multiply 75432 by 47. Ans. 3545304.
- Multiply 76785316 by 7615, Ans. 574720181340.
- Multiply 67853000 by 8765. Ans. 594731545000.
- Multiply 38123450 by 31243. Ans. 1191090948350.
- Multiply 40670007 by 10002. Ans. 406781410014.
- Multiply 31235678 by 10203. Ans. 318697622634.
- Multiply 76786321 by 30070. Ans. 2308964672470.
- Multiply 317160070 by 700500. Ans. 222170629035000.
- Multiply 467325812 by 167000. Ans. 78043410604000.
- Multiply 6176777 by 22222. Ans. 1372603540494.
- Multiply 123456789 by 987654321. Ans. 121932631112635269.
- What will 27 oxen cost at 35 dollars each ? Ans. 945 dols.

24. What will 365 acres of land cost at 73 dollars per acre?
Ans. 26645 dols.

25. What will 97 tons of iron cost at 57 dollars a ton?
Ans. 5529 dols.

26. What will 397 yards of cloth cost at 7 dollars per yard?
Ans. 2779 dols.

27. What will 569 hogsheads of molasses cost at 37 dollars per hogshead?
Ans. 41053 dols.

28. If a man travel 37 miles in one day how far will he travel in 365 days?
Ans. 13505 miles.

29. If one quire of paper have 24 sheets, how many sheets are in a ream, which consists of 20 quires?
Ans. 480 sheets.

30. If a vessel sails 169 miles in one day, how far will she sail in 144 days?
Ans. 23336 miles.

31. What will 698 barrels of flour cost at 7 dollars a barrel?
Ans. 4886 dols.

32. What will 376 lbs. of sugar cost at 13 cents a pound?
Ans. 4888 cts.

33. What will 97 lbs. of tea cost at 93 cents a pound?
Ans. 9021 cts.

34. If a regiment of soldiers consists of 1128 men, how many men are there in an army of 53 regiments?
Ans. 60284.

35. What will an ox weighing 569 pounds amount to at 8 cents a pound?
Ans. 4552 cts.

36. If a barrel of cider can be bought for 93 cents, what will 75 barrels cost?
Ans. 6975 cts.

37. If in a certain factory 786 yards of cloth are made in one day, how many will be made in 313 days?
Ans. 246018 yds.

38. A certain house contains 87 windows, and each window has 32 squares of glass, how many squares are there in the whole house?
Ans. 2784 squares.

39. There are 407 wagons each loaded with 30009 pounds of coal, how many pounds are there in the whole?
Ans. 12213663 pounds.

40. Multiply three hundred and seventy-five millions two hundred and ninety-six thousand three hundred and twenty-one, by seventy-nine thousand and twenty-four.
Ans. 59657416470704.

41. What would be the cost of 687 fother of lead at 73 dollars a fother?
Ans. 50151 dols.

MENTAL OPERATIONS IN DIVISION.

1. How many times is 1 contained in 2?
- How many times 2 are there in 4?
- How many times 3 are there in 6?
- How many times 2 are there in 8?
- How many times 3 are there in 9?
- How many times 2 are there in 10?
- How many times 4 are there in 8?
- How many times is 2 contained in 6?
- How many times is 5 contained in 10? 2 is contained in 12, how many times? 4 in 12 how many times? 3 in 12 how many times? 6 in 12 how many times?
2. James had 8 apples, and John had half as many, how many had he?
3. How many pears at 2 cents a piece can you buy for 4 cents?
4. If you have 8 apples to give to 4 boys, how many can you give to each?
5. Joseph has 12 pears, which he wishes to distribute equally between 6 of his companions, how many can he give them apiece?
6. If a man travel 3 miles in an hour, how many hours will it take him to travel 12 miles?
7. Fourteen are how many time 2?
8. At 6 cents apiece, how many oranges can you buy for 18 cents?
9. If 1 pencil cost 2 cents, how many can you buy for 20 cents?
10. If you can buy 1 slate for 6 cents, how many can you buy for 30 cents?
11. If you had 60 cents, how many quires of paper could you buy at 20 cents per quire?
12. If one pound of raisins cost 12 cents, how many pounds may be bought for 60 cents?
13. If 10 dollars will buy 1 ton of hay, how many tons may be bought for 30 dollars?
14. 24 are how many times 4? are how many times 6? are how many times 8? are how many times 12?
15. 27 are how many times 3? how many times 9?
16. 28 are how many times 4? how many times 7?

17. 30 are how many times 3? how many times 5? how many times 15? how many times 6? how many times 10?

18. 32 are how many times 4? 8? 16?

19. 36 are how many times 4? 6? 9? 12?

20. 40 are how many times 4? 5? 8? 10?

21. 42 are how many times 6? 7? 14? 21?

22. 48 are how many times 4? 6? 8? 12?

23. 56 are how many times 4? 7? 8?

24. 60 are how many times 3? 4? 5? 6? 10? 12?

25. 64 are how many times 4? 8? 16?

26. 66 are how many times 2? 3? 6? 22? 33?

27. 72 are how many times 8? 9? 12?

28. 84 are how many times 7? 12?

29. A man buys 6 sheep for 48 dollars; what did he give apiece?

30. James gave 72 cents for 8 quarts of cherries; what were they a quart?

31. Thomas gave 96 cents for 8 penknives; what was the price of each?

32. Benjamin had 37 nuts; he gave 7 to James, and divided the remainder equally between himself and two sisters; how many will be his share?

33. Thomas has 98 cents; he gave his sister Nancy 18 and divided the remainder between himself and 9 others; how many will each have?

34. Daniel has 47 apples; he gave William 7 and Samuel 10; how many will he have, if he share the remainder with himself and 2 brothers?

DIVISION.

DIVISION is a short or compendious way of performing Subtraction. Its object is to find how many times one number is contained in another. It consists of four parts; the dividend or number to be divided; the divisor or the number to be divided by; the quotient, which shows how many times the divisor is contained in the dividend and the; remainder, which is always less than the divisor, and of the same name of the dividend.

RULE I.

Place the divisor before the dividend, and inquire how many times it is contained in a competent number of figures in the dividend, and place the result in the quotient; multiply the figure in the quotient by the divisor, and place the product under those figures in the dividend, in which it was inquired how many times the divisor was contained; subtract this product from the dividend, and to the remainder, bring down the next figure of the dividend, and then inquire how many times this number will contain the divisor, and place the result in the quotient, and proceed as before, until all the figures in the dividend are brought down.

NOTE.—It will sometimes happen, that after a figure is brought down, that the number will not contain the divisor, a cipher is then to be placed in the quotient, and another figure is to be brought down, and so continue until it will contain the divisor, placing a cipher each time in the quotient.

EXAMPLE.

| 1. | Proof. |
|-----------------|--------|
| 17)197679(11628 | 11628 |
| 17 | 17 |
| — | — |
| 27 | 81396 |
| 17 | 116283 |
| — | — |
| 106 | 197679 |
| 102 | |
| — | |
| 47 | |
| 34 | |
| — | |
| 139 | |
| 136 | |
| — | |
| 3 | |

7, and inquire how many times 27 will contain 17; I find it to be 1; I then place 1 in the quotient and multiply it by the divisor 17 as before, and place the product under the 27, and subtract it from the 27 and find the remainder to be 10; I then bring down the next figure 6, and place it to the right hand of the 10, which will make 106. I then inquire how many

My object in this question is to find how often seventeen may be contained in one hundred ninety-seven thousand six hundred and seventy-nine; my first inquiry is, how many times 17 may be contained in 19; I find it to be 1; this I place in the quotient, and multiply it by 17, the divisor, and place the product under the 19; I then subtract 17 from 19 and find the remainder to be 2; I then bring down the next figure

times 17 may be had in it; I find it to be 6 times; I place the 6 in the quotient and multiply it by my divisor as before, and find the product to be 102; this I place under the 106, and subtract it, and find the remainder to be 4; I then bring down the next figure 7, and inquire how often 47 will contain 17; and I find it to be 2; this I place in the quotient, and multiply it by the divisor, and find the product to be 34; this I place under the 47, and subtract it, and find the remainder to be 13. I then bring down the last figure 9, and inquire how often 139 will contain 17, and find it to be 8; this I place in the quotient, and multiply it by the divisor, and place the product 136 under the 139, and subtract it, and find the remainder to be 3.

By this process, I find the dividend contains the divisor 11628 times, and 3 for a remainder.

NOTE.—The remainder in all cases is less than the divisor, and of the same denomination of the dividend; and, if at any time, I subtract the product of the figures in the quotient and the divisor from the dividend, and the remainder is more than the divisor, my figure in the quotient is not large enough.

PROOF.

Division may be proved by Multiplication, Addition, casting out the 9's, or by Division itself.

To prove it by Multiplication, the divisor must be multiplied by the quotient, and to the product, the remainder must be added, and if the result be like the dividend, the work is right, See example 1.

To prove it by Addition—Add up the several products of the divisor and quotient with the remainder, and if the result be like the dividend the work is right. See ex. 2, and 3.

To prove it by casting out the 9's—Cast the 9's out of the divisor, and place the remainder at the left hand of the *cross*; then cast them out of the quotient, and place the remainder at the right hand of the cross, and lastly subtract the remainder from the dividend, and cast the 9's out of what may remain, and place the result at the top of the cross; and if it be like the product of the figures at the sides of the cross (after the 9's are cast out of their products) the work is right. See ex. 3.

To prove it by Division itself, subtract the remainder from the dividend, and divide this number by the quotient, and the quotient found by this division, will be equal to the former divisor, when the work is right. See ex. 4.

EXAMPLES.

$$\begin{array}{r} 97 \overline{)147856(1524} \\ 97^* \end{array}$$

$$\begin{array}{r} 508 \\ 485^* \end{array}$$

$$\begin{array}{r} 235 \\ 194^* \end{array}$$

$$\begin{array}{r} 416 \\ 388^* \end{array}$$

$$\begin{array}{r} 28^* \end{array}$$

$$\underline{147856}$$

$$\begin{array}{r} 328 \overline{)678767(2069} \\ 656 \end{array}$$

$$\begin{array}{r} 2276 \\ 1968 \end{array}$$

$$\begin{array}{r} 3087 \\ 2952 \end{array}$$

$$\begin{array}{r} 135 \end{array}$$

$$\underline{678632}$$

Proof.

$$\begin{array}{r} 5 \\ 4 \times 8 \\ 5 \end{array}$$

* NOTE.—The asterisms show the numbers to be added.

$$\begin{array}{r} 72 \overline{)37895(526} \\ 360 \end{array}$$

$$\begin{array}{r} 189 \\ 144 \end{array}$$

$$\begin{array}{r} 455 \\ 432 \end{array}$$

$$\underline{23}$$

$$\begin{array}{r} 37895 \\ 23 \end{array}$$

$$\begin{array}{r} 526 \overline{)37872(72} \\ 3682 \end{array}$$

$$\begin{array}{r} 1052 \\ 1052 \end{array}$$

| | | | Quotients. | Remainders. |
|------------|-------------|------|------------|-------------|
| 5. Divide | 6756785 by | 35 | 193051 | |
| 6. Divide | 789636 by | 46 | 17166 | |
| 7. Divide | 7967848 by | 52 | 15324 | |
| 8. Divide | 16785675 by | 61 | 275175 | |
| 9. Divide | 675753 by | 39 | 17327 | |
| 10. Divide | 5678910 by | 82 | 69255 | |
| 11. Divide | 6716394 by | 94 | 71451 | |
| 12. Divide | 1167861 by | 135 | 8650 | 111 |
| 13. Divide | 7861783 by | 87 | 90365 | 28 |
| 14. Divide | 1678567 by | 365 | 4598 | 297 |
| 15. Divide | 87635163 by | 387 | 226447 | 174 |
| 16. Divide | 34567890 by | 6789 | 5091 | 5091 |

| | | Quotients. | Remainders. |
|------------|-----------------------|------------|-------------|
| 17. Divide | 78911007 by 36712 | 2149 | 16919 |
| 18. Divide | 78963167 by 45671 | 1731 | 6666 |
| 19. Divide | 671616589 by 61476 | 10924 | 52765 |
| 20. Divide | 471361876 by 36789 | 12812 | 21208 |
| 21. Divide | 300700801 by 10037 | 29999 | 2318 |
| 22. Divide | 10000000 by 9999 | 1000 | 1000 |
| 23. Divide | 199999999 by | 123456 | |
| 24. Divide | 6716789513 by | 7816789 | |
| 25. Divide | 1613716131 by | 3151638 | |
| 26. Divide | 121932631112635269 by | 123456789 | |

To divide by any number with ciphers annexed.

RULE II.

Cut off the ciphers from the divisor, and the same number of digits from the right hand of the dividend; then divide the remaining figures as in the last case, and the quotient is the answer; and what remains written before the figures cut off is the true remainder.

Divide 36378967 by 31000.

31,000)36378,967(1173

31

53

31

227

217

108

93

15967 Remainder.

| | | Quotients | Remainders. |
|-----------|---------------------|-----------|-------------|
| 1. Divide | 32100 by 6000 | 5 | 2100 |
| 2. Divide | 3167810 by 160000 | 19 | 127810 |
| 3. Divide | 12345678 by 1400000 | 8 | 1145678 |
| 4. Divide | 1637851 by 500000 | 3 | 137851 |
| 5. Divide | 3678953 by 326100 | 11 | 91853 |
| 6. Divide | 41111111 by 1100000 | 37 | 411111 |

To divide by an unit with ciphers annexed.

RULE III.

Cut off as many figures from the right hand of the dividend, as there are ciphers in the divisor, and the figures on the left hand of the separation will be the quotient, and those on the right hand the remainder.

| | | | Quotients. | Rem. |
|-----------|--------------|------------|------------|--------|
| 1. Divide | 123456789 | by 10 | 12345678 | 9 |
| 2. Divide | 987654321 | by 100 | 9876543 | 21 |
| 3. Divide | 122112347800 | by 1000 | 122112347 | 800 |
| 4. Divide | 89765432156 | by 1000000 | 89765 | 432156 |

SHORT DIVISION.

See how many times the divisor may be had in the first figure or figures of the dividend, and place the result immediately under that figure, and what remains suppose to be placed directly before the next figure of the dividend, and then inquire how many times these two figures will contain the divisor, and place the result as before; and so proceed, until the question is finished.

EXAMPLES.

¹
Dividend.
 Divisor 3)7647 In performing this question, I inquire how
 many times 3 may be had in 7, which I find
 Quotient 2549 to be 2 times and 1 remaining; I place the
 2 under the 7, and suppose my remainder 1
 to be standing before my next figure of the dividend 6, and it
 would then be 16. I then inquire how many times 16 will
 contain my divisor 3; I find it to be 5 times and 1 remaining.
 I place my 5 under the 6, and the unit that was remaining I
 suppose to be placed before the next figure of the dividend 4;
 and it would be 14. I next inquire how many times 3 is con-
 tained in 14; I find it to be 4 times and 2 remaining; I place
 this 4 under the 4 of the dividend, and my remainder 2 I
 suppose to be placed before the 7; and it would then be 27. In

the last place, I inquire how many times 27 will contain my divisor, I find it to be 9 times; this I place under the 7 of the dividend and the question is finished.

$$\begin{array}{r} 4 \overline{)67856336} \end{array}$$

$$\begin{array}{r} 5 \overline{)123456789} \end{array}$$

$$\begin{array}{r} 6 \overline{)98786356} \end{array}$$

$$\begin{array}{r} 7 \overline{)126711001} \end{array}$$

$$\begin{array}{r} 8 \overline{)33445567} \end{array}$$

$$\begin{array}{r} 9 \overline{)1234567} \end{array}$$

$$\begin{array}{r} 10 \overline{)178985} \end{array}$$

$$\begin{array}{r} 11 \overline{)1667789} \end{array}$$

$$\begin{array}{r} 12 \overline{)9167856} \end{array}$$

| | | Quotients. | Rem. |
|------------|-----------------|------------|------|
| 11. Divide | 67893536 by 2 | 33946768 | |
| 12. Divide | 316789311 by 3 | 105596437 | |
| 13. Divide | 567895326 by 4 | 141973831 | 2 |
| 14. Divide | 123456789 by 5 | 24691357 | 4 |
| 15. Divide | 671678953 by 6 | 111946492 | 1 |
| 16. Divide | 166336711 by 7 | 23762387 | 2 |
| 17. Divide | 161331793 by 8 | 20166474 | 1 |
| 18. Divide | 161677678 by 9 | 17964186 | 4 |
| 19. Divide | 363895678 by 11 | 33081425 | 3 |
| 20. Divide | 164378956 by 12 | 13698246 | 4 |

MISCELLANEOUS EXAMPLES.

- What number multiplied by 1728 will produce 1705536?
Ans. 987.
- If a garrison of 987 men are supplied with 175686 pounds of beef, how much will there be for each man?
Ans. 178 lbs.
- In one dollar there are 100 cents, how many dollars in 697800 cents?
Ans. 6978 dols
- In one pound there are 16 ounces, how many pounds are in 111680 ounces?
Ans. 6980 lbs.
- A dollar contains 6 shillings, how many dollars are in 5868 shillings?
Ans. 978 dols.

6. The President of the United States receives a salary of 40,000 dollars; what does he receive per month?

Ans. 3,333 $\frac{1}{3}$ dols.

7. A man receiving 96 dollars for 8 months' labor, what does he receive for 1 month?

Ans. 12 dols.

8. The distance from Haverhill to Boston is 30 miles; and if a man travel 6 miles an hour, how long will he be in going this distance?

Ans. 5 hours.

9. The annual revenue of a gentleman being 8395 dollars, how much per day is that equivalent to, there being 365 days in a year?

Ans. 23 dols.

10. The car on the Liverpool rail-road goes at the rate of 65 miles an hour; how long would it take to pass round the globe, the distance being about 25,000 miles?

Ans. 384 $\frac{2}{3}$ hours.

11. How much sugar at 15 dollars per cwt. may be bought for 405 dollars?

Ans. 27 cwt.

12. In 6789560 shillings how many pounds, there being 20 shillings in a pound?

Ans. 339478 pounds.

13. The Bible contains 31,173 verses; how many must be read each day, that the book may be read through in a year?

Ans. 85 $\frac{1}{11}$ verses.

14. In 123456720 minutes how many hours?

Ans. 2057612 hours.

15. A gentleman possessing an estate of 66,144 dollars, bequeathed one fourth to his wife, and the remainder was to be divided between his 4 children; what was the share of each?

Ans. 12,402 dols.

16. A man disposed of a farm, containing 175 acres at 87 dollars per acre; of the avails he distributed \$1234 for charitable purposes; \$197 was expended for the purchase of a horse and chaise; the remainder was divided between 6 gentlemen and 8 ladies, and each lady was to receive twice as much as a gentleman; what was the share of each?

Ans. 627 dols. for a gentleman, and 1254 for a lady.

TABLES OF MONEY, WEIGHTS, AND MEASURES.

UNITED STATES' MONEY.

| | | | | |
|------------|------|-----------|--------|-----|
| 10 Mills | make | 1 Cent, | marked | c. |
| 10 Cents | " | 1 Dime, | " | d. |
| 10 Dimes | " | 1 Dollar, | " | \$. |
| 10 Dollars | " | 1 Eagle, | " | E. |

| Mills. | | Cents, | | Dime. | | Dollar. | | Eagle. |
|--------|---|--------|---|-------|---|---------|---|--------|
| 10 | = | 1 | | 1 | | | | |
| 100 | = | 10 | = | 1 | | | | |
| 1000 | = | 100 | = | 10 | = | 1 | | |
| 10000 | = | 1000 | = | 100 | = | 10 | = | 1 |

ENGLISH MONEY.

| | | | | |
|--------------|------|-------------|--------|----|
| 4 Farthings | make | 1 Penny, | marked | d. |
| 12 Pence | " | 1 Shilling, | " | s. |
| 20 Shillings | " | 1 Pound, | " | £ |

| grs. | | d. | | s. | | £ |
|------|---|-----|---|----|---|---|
| 4 | = | 1 | | 1 | | |
| 48 | = | 12 | = | 1 | | |
| 960 | = | 240 | = | 20 | = | 1 |

FRENCH MONEY.

100 Centimes make 1 Franc = 1875 dollars.

TROY WEIGHT.

| | | | | |
|-----------------|------|----------------|--------|------|
| 24 Grains | make | 1 Pennyweight, | marked | dwt. |
| 20 Pennyweights | " | 1 Ounce, | " | oz. |
| 12 Ounces | " | 1 Pound, | " | lb. |

| grs. | | dwt. | | oz. | | lb. |
|------|---|------|---|-----|---|-----|
| 24 | = | 1 | | 1 | | |
| 480 | = | 20 | = | 1 | | |
| 5760 | = | 240 | = | 12 | = | 1 |

By this weight are weighed gold, silver, and jewels.

NOTE.—“The original of all weights used in England, was a grain or corn of wheat, gathered out of the middle of the ear; and, being well dried, 32 of them were to make one pennyweight, 20 pennyweights one ounce, and 12 ounces one pound. But in latter times, it was thought sufficient to divide the same pennyweight into 24 equal parts, still called grains, being the least weight now in common use; and from hence the rest are computed.”

APOTHECARIES' WEIGHT.

| | | | | |
|------------|------|------------|--------|----------------------|
| 20 Grains | make | 1 Scruple, | marked | sc. or \varnothing |
| 3 Scruples | " | 1 Dram, | " | dr. or 3 |
| 8 Drams | " | 1 Ounce, | " | oz. or $\frac{1}{2}$ |
| 12 Ounces | " | 1 Pound, | " | lb. or lb |

| | | | | | | | | |
|------|---|-----|---|-----|---|-----|---|-----|
| gr. | | sc. | | dr. | | oz. | | lb. |
| 20 | = | 1 | | 1 | | | | |
| 60 | = | 3 | = | 1 | | | | |
| 480 | = | 24 | = | 8 | = | 1 | | |
| 5760 | = | 288 | = | 96 | = | 12 | = | 1 |

Apothecaries mix their medicines by this weight; but buy and sell by Avoirdupois. The pound and ounce of this weight are the same as in Troy Weight.

AVOIRDUPOIS WEIGHT.

| | | | | |
|-------------------|------|-------------------|--------|------|
| 16 Drams | make | 1 Ounce, | marked | oz. |
| 16 Ounces | " | 1 Pound, | " | lb. |
| 28 Pounds | " | 1 Quarter, | " | gr. |
| 4 Quarters | " | 1 Hundred Weight, | " | cwt. |
| 20 Hundred Weight | " | 1 Ton, | " | ton. |

| | | | | | | | | | | |
|--------|---|-------|---|------|---|-----|---|------|---|------|
| dr. | | oz. | | lb. | | gr. | | cwt. | | ton. |
| 16 | = | 1 | | 1 | | | | | | |
| 256 | = | 16 | = | 1 | | | | | | |
| 7168 | = | 448 | = | 28 | = | 1 | | | | |
| 28672 | = | 1792 | = | 112 | = | 4 | = | 1 | | |
| 573440 | = | 35840 | = | 2240 | = | 80 | = | 20 | = | 1 |

By this weight are weighed almost every kind of goods, and all metals except gold and silver. By a late law of Massachusetts, the cwt. contains 100 lbs. instead of 112 lbs.

LONG MEASURE.

| | | | | |
|------------------|------|------------------------|--------|-----------|
| 3 Barley-corns | make | 1 Inch, | marked | in. |
| 12 Inches | " | 1 Foot, | " | ft. |
| 3 Feet | " | 1 Yard, | " | yd. |
| 6 Feet | " | 1 Fathom, | " | fth. |
| 5½ Yards | " | 1 Pole or Rod, | " | pl. |
| 40 Poles | " | 1 Furlong, | " | fur. |
| 8 Furlongs | " | 1 Mile, | " | mile. |
| 3 Miles | " | 1 League, | " | lea. |
| 69½ Miles nearly | " | 1 Degree, | " | Deg. or ° |
| 360 Degrees | " | 1 Circle of the Earth. | | |

| In. | Ft. | Yd. | Fl. | Fur. | Mile. |
|---------|--------|--------|-------|------|-------|
| 12 = | 1 | | | | |
| 36 = | 3 = | 1 | | | |
| 192 = | 16½ = | 5½ = | 1 | | |
| 7920 = | 660 = | 220 = | 40 = | 1 | |
| 63360 = | 5280 = | 1760 = | 320 = | 8 = | 1 |

CLOTH MEASURE.

| | | |
|--------------------|------------------------|------------|
| 2½ Inches | make 1 Nail, | marked Nl. |
| 4 Nails | " 1 Quarter of a Yard, | " Qr. |
| 3 Quarters | " 1 Ell Flemish, | " E. F. |
| 4 Quarters | " 1 Yard, | " Yd. |
| 5 Quarters | " 1 Ell English, | " E. E. |
| 4 Quarters 1½ inch | " 1 Ell Scotch, | " E. S. |

SQUARE MEASURE.

| | | |
|-------------------|---------------------|------------|
| 144 Square Inches | make 1 Square Foot, | marked Ft. |
| 9 Square Feet | " 1 Square Yard, | " Yd. |
| 30½ Square Yards | " 1 Square Pole, | " pl. |
| 40 Square Poles | " 1 Rood, | " R. |
| 4 Roods | " 1 Acre, | " A. |
| 640 Acres | " 1 Square Mile, | " S. M. |

| Sq. Inch. | Sq. Ft. | Sq. Yd. | Sq. Pl. | Rd. | Acr. | Mile. |
|--------------|------------|-----------|----------|--------|-------|-------|
| 144 = | 1 = | | | | | |
| 1596 = | 9 = | 1 | | | | |
| 39204 = | 272½ = | 30½ = | 1 | | | |
| 1568160 = | 10890 = | 1210 = | 40 = | 1 | | |
| 6272640 = | 43560 = | 4840 = | 160 = | 4 = | 1 | |
| 4014489600 = | 27878400 = | 3097600 = | 102400 = | 2560 = | 640 = | 1 |

DRY MEASURE.

| | | |
|-------------|-------------------------|------------|
| 2 Pints | make 1 Quart, | marked Qt. |
| 2 Quarts | " 1 Pottle, | " Pot. |
| 2 Pottles | " 1 Gallon, | " Gal. |
| 2 Gallons | " 1 Peck, | " Pec. |
| 4 Pecks | " 1 Bushel, | " Bu. |
| 8 Bushels | " 1 Quarter, | " Qr. |
| 4 Quarters | " 1 Chaldron, | |
| 4½ Quarters | " 1 Chaldron in London, | |
| 5 Quarters | " 1 Wey Load, or Ton, | " Wey. |
| 2 Weys | " 1 Last, | " Last. |

| | | | | | | | |
|--------|-------|-------|------|------|------|-------|--|
| Pts. | Gal. | | | | | | |
| 8 = | 1 | Pec. | | | | | |
| 16 = | 2 = | 1 | Bu. | | | | |
| 64 = | 8 = | 4 = | 1 | Qr. | | | |
| 512 = | 64 = | 32 = | 8 = | 1 | Wey. | | |
| 2560 = | 320 = | 160 = | 40 = | 5 = | 1 | Last. | |
| 5120 = | 640 = | 320 = | 80 = | 10 = | 2 = | 1 | |

NOTE.—This measure is applied to all Dry Goods, as Corn, Fruit, Salt, Coals, &c. A Winchester Bushel is $18\frac{1}{4}$ inches in diameter, and 8 inches deep. The standard Gallon Dry Measure contains 268 $\frac{1}{4}$ cubic inches.

ALE AND BEER MEASURE.

| | | | | |
|--------------|------|-------------------|--------|-------|
| 2 Pints | make | 1 Quart, | marked | qt. |
| 4 Quarts | " | 1 Gallon, | " | gal. |
| 8 Gallons | " | 1 Firkin of Ale, | " | fir. |
| 9 Gallons | " | 1 Firkin of Beer, | " | fir. |
| 2 Firkins | " | 1 Kilderkin, | " | kil. |
| 2 Kilderkins | " | 1 Barrel, | " | bar. |
| 36 Gallons | " | 1 Barrel, | " | bar. |
| 54 Gallons | " | 1 Hogshead, | " | hhd. |
| 2 Hogsheads | " | 1 Butt, | " | butt. |
| 2 Butts | " | 1 Tun, | " | tun. |

| | | | | | | | |
|-------|-------|-------|------------------|------|-------|--|--|
| Pts. | Qt. | | | | | | |
| 2 = | 1 | Gal. | | | | | |
| 8 = | 4 = | 1 | Bar. | | | | |
| 288 = | 144 = | 36 = | 1 | Hhd. | | | |
| 432 = | 216 = | 54 = | $1\frac{1}{2}$ = | 1 | Butt. | | |
| 864 = | 432 = | 108 = | 3 = | 2 = | 1 | | |

NOTE.—The Ale Gallon contains 282 cubic or solid inches.

WINE MEASURE.

| | | | | |
|---------------------------------------|------|-----------------|--------|-------|
| 2 Pints | make | 1 Quart, | marked | qt. |
| 4 Quarts | " | 1 Gallon, | " | gal. |
| 42 Gallons | " | 1 Tierce, | " | tier. |
| 63 Gallons, or $1\frac{1}{2}$ Tierces | " | 1 Hogshead, | " | hhd. |
| 2 Tierces | " | 1 Puncheon, | " | pun. |
| 2 Hogsheads | " | 1 Pipe or Butt, | " | pi. |
| 2 Pipes, or 4 Hhds. | " | 1 Tun, | " | tun. |

Or, $\begin{matrix} \text{Wk.} \\ 52 \end{matrix} \begin{matrix} \text{Day.} \\ 1 \end{matrix} \begin{matrix} \text{Hr.} \\ 6 \end{matrix} = \begin{matrix} \text{Mo.} \\ 13 \end{matrix} \begin{matrix} \text{Day.} \\ 1 \end{matrix} \begin{matrix} \text{Hr.} \\ 6 \end{matrix} = 1 \text{ Julian Year.}$

But, $\begin{matrix} \text{Day.} \\ 365 \end{matrix} \begin{matrix} \text{Hr.} \\ 5 \end{matrix} \begin{matrix} \text{M.} \\ 48 \end{matrix} \begin{matrix} \text{Sec.} \\ 57 \end{matrix} = 1 \text{ Solar Year.}$

CIRCULAR MOTION.

60 seconds make 1 prime minute, marked " ' .
 60 minutes " 1 degree, " ° .
 30 degrees " 1 sign, " s .
 12 signs, or 360 degrees, the whole great circle of the zodiac.

$\begin{matrix} \text{Sec.} \\ 60 \end{matrix} = \begin{matrix} \text{Min.} \\ 1 \end{matrix} \begin{matrix} \text{Deg.} \\ 1 \end{matrix} \begin{matrix} \text{Sign.} \\ 1 \end{matrix}$
 $\begin{matrix} 3600 \end{matrix} = \begin{matrix} 60 \end{matrix} = \begin{matrix} 1 \end{matrix} \begin{matrix} \text{Sign.} \\ 1 \end{matrix}$
 $\begin{matrix} 108000 \end{matrix} = \begin{matrix} 1800 \end{matrix} = \begin{matrix} 30 \end{matrix} = \begin{matrix} 1 \end{matrix}$
 $\begin{matrix} 1296000 \end{matrix} = \begin{matrix} 21600 \end{matrix} = \begin{matrix} 360 \end{matrix} = \begin{matrix} 12 \end{matrix} = \text{zodiac.}$

MEASURING DISTANCES.

$7\frac{92}{100}$ inches make 1 link.
 25 links " 1 pole.
 100 links " 1 chain.
 10 chains " 1 furlong.
 8 furlongs " 1 mile.

$\begin{matrix} \text{Inches.} \\ 7\frac{92}{100} \end{matrix} = \begin{matrix} \text{Link.} \\ 1 \end{matrix} \begin{matrix} \text{Pole.} \\ 1 \end{matrix} \begin{matrix} \text{Chain.} \\ 1 \end{matrix} \begin{matrix} \text{Furlong.} \\ 1 \end{matrix} \begin{matrix} \text{Mile.} \\ 1 \end{matrix}$
 $192 = 25 = 1$
 $792 = 100 = 4 = 1$
 $7920 = 1000 = 40 = 10 = 1$
 $63360 = 8000 = 320 = 80 = 8 = 1$

SOLID MEASURE.

1728 inches make 1 foot.
 27 feet " 1 yard.
 40 feet of round timber, or 50 feet of
 hewn timber, } 1 ton.
 128 feet, i. e. 8 in length, 4 in breadth,
 and four in height, make } 1 cord of wood.

MISCELLANEOUS TABLE.

| | | |
|---|--------|----------------|
| A gallon of train oil | weighs | 7½ pounds. |
| A stone of butchers' meat | " | 8 " |
| A gallon of molasses | " | 11 " |
| A stone of iron | " | 14 " |
| A tod | " | 28 " |
| A firkin of butter | " | 56 " |
| A firkin of soap | " | 94 " |
| A quintal of fish | " | 112 " |
| A weigh | " | 182 " |
| A sack | " | 364 " |
| A punch. of foreign prunes | " | 1120 " |
| A last | " | 4368 " |
| A fother of lead | " | 19½ cwt. |
| A barrel of anchovies | " | 30 pounds. |
| " raisins | " | 112 " |
| " flour | " | 196 " |
| " pork or beef | " | 200 " |
| " soap | " | 256 " |
| " shad or salmon in } Conn. or New York, } | " | 200 " |
| " fish in Mass'ts | is | 30 gallons. |
| " cider | " | 32 " |
| " herrings in England | " | 32 " |
| " salmon, or eels do. | " | 42 " |
| 8 bushels of salt, measured on } board the vessel, | " | 1 hogshead. |
| 7½ do. measured on shore, | " | " |
| 3 hoops | make | 1 cast. |
| 40 casts | " | 1 hundred. |
| 10 hundred | " | 1 thousand. |
| 12 units, or things, | " | 1 dozen. |
| 12 dozen | " | 1 gross. |
| 144 dozen | " | 1 great gross. |

COMPOUND ADDITION.

COMPOUND ADDITION is the adding together of two or more numbers of different denominations.

RULE.

Place all the given numbers of the same denomination under each other; then add the numbers of the first denomination together, and divide the sum by so many as make one of the next denomination; set the remainder under its column, and add the quotient to the next column; which add together and divide as before; thus proceed to the last denomination, under which, place its whole sum.

UNITED STATES' MONEY.

| ¢ | cts. | m. | ¢ | cts. | m. | E. ¢ | cts. | m. |
|-------|------|----|-------|------|----|-------|------|------|
| 325 | 67 | 3 | 28 | 15 | 6 | 71 | 3 | 41 5 |
| 186 | 35 | 8 | 16 | 16 | 3 | 61 | 6 | 82 6 |
| 161 | 89 | 9 | 63 | 81 | 5 | 16 | 1 | 96 2 |
| 987 | 15 | 8 | 14 | 61 | 6 | 41 | 7 | 82 1 |
| 891 | 61 | 6 | 38 | 74 | 5 | 54 | 8 | 36 3 |
| 176 | 81 | 3 | 16 | 16 | 8 | 41 | 9 | 48 5 |
| <hr/> | | | <hr/> | | | <hr/> | | |
| 2729 | 51 | 7 | | | | | | |

ENGLISH MONEY.

| £ | s. | d. | £ | s. | d. | £ | s. | d. | qr. |
|-------|----|----|-------|----|-----|-------|----|----|-----|
| 471 | 16 | 9 | 28 | 6 | 9½ | 31 | 17 | 9 | 2 |
| 147 | 17 | 8 | 15 | 16 | 11¼ | 16 | 16 | 6 | 1 |
| 613 | 13 | 11 | 31 | 13 | 10½ | 16 | 11 | 11 | 1 |
| 115 | 11 | 7 | 14 | 16 | 9 | 19 | 19 | 9 | 3 |
| 41 | 19 | 6 | 17 | 17 | 7¼ | 61 | 17 | 1 | 3 |
| 48 | 12 | 2 | 32 | 18 | 8¼ | 14 | 14 | 4 | 2 |
| <hr/> | | | <hr/> | | | <hr/> | | | |
| 1439 | 11 | 7 | | | | | | | |

COMPOUND ADDITION.

TROY WEIGHT.

| lb. | oz. | pwt. | gr. | lb. | oz. | pwt. | gr. |
|-------|-----|------|-----|-------|-----|------|-----|
| 16 | 11 | 19 | 23 | 123 | 9 | 7 | 13 |
| 31 | 10 | 18 | 16 | 98 | 11 | 17 | 14 |
| 63 | 9 | 12 | 15 | 49 | 7 | 13 | 21 |
| 17 | 8 | 13 | 12 | 13 | 10 | 10 | 20 |
| 61 | 7 | 12 | 16 | 47 | 9 | 19 | 23 |
| 17 | 6 | 17 | 22 | 51 | 5 | 15 | 15 |
| <hr/> | | | | <hr/> | | | |
| 209 | 7 | 15 | 8 | | | | |

APOTHECARIES' WEIGHT.

| lb. | 3. | ʒ. | ʒ. | ʒ. | gr. | lb. | 3. | ʒ. | ʒ. | ʒ. | gr. |
|-------|----|----|----|----|-----|-------|----|----|----|----|-----|
| 27 | 11 | 7 | 2 | 19 | | 37 | 9 | 6 | 1 | 18 | |
| 16 | 10 | 6 | 1 | 13 | | 14 | 4 | 4 | 2 | 11 | |
| 41 | 9 | 3 | 2 | 16 | | 61 | 6 | 3 | 2 | 6 | |
| 38 | 10 | 5 | 2 | 14 | | 41 | 4 | 7 | 2 | 16 | |
| 41 | 4 | 4 | 1 | 11 | | 39 | 8 | 4 | 1 | 12 | |
| 16 | 6 | 6 | 2 | 6 | | 51 | 11 | 7 | 2 | 19 | |
| <hr/> | | | | | | <hr/> | | | | | |
| 183 | 6 | 3 | 1 | 19 | | | | | | | |

AVOIRDUPOIS WEIGHT.

| Ton. | cwt. | qr. | lb. | oz. | dr. | cwt. | qr. | lb. | oz. | dr. |
|-------|------|-----|-----|-----|-----|-------|-----|-----|-----|-----|
| 61 | 19 | 3 | 27 | 15 | 15 | 61 | 2 | 11 | 11 | 14 |
| 63 | 13 | 3 | 16 | 11 | 11 | 16 | 3 | 15 | 15 | 11 |
| 51 | 12 | 3 | 17 | 7 | 6 | 41 | 3 | 13 | 9 | 9 |
| 61 | 16 | 1 | 11 | 12 | 12 | 38 | 2 | 11 | 10 | 10 |
| 13 | 13 | 3 | 12 | 13 | 15 | 42 | 1 | 9 | 8 | 13 |
| 71 | 18 | 2 | 13 | 14 | 14 | 31 | 3 | 27 | 11 | 12 |
| <hr/> | | | | | | <hr/> | | | | |
| 324 | 15 | 2 | 16 | 12 | 9 | | | | | |

LONG MEASURE.

| Deg. | m. | fur. | rd. | ft. | in. | br. | M. | fur. | rd. | m. | ft. | in. | br. |
|-------|----|------|-----|-----|-----|-----|-------|------|-----|----|-----|-----|-----|
| 17 | 69 | 7 | 39 | 16 | 11 | 2 | 69 | 7 | 31 | 5 | 2 | 11 | 1 |
| 61 | 62 | 3 | 17 | 12 | 9 | 1 | 16 | 6 | 16 | 4 | 1 | 6 | 2 |
| 16 | 16 | 6 | 16 | 13 | 10 | 2 | 61 | 7 | 32 | 3 | 2 | 10 | 1 |
| 48 | 19 | 3 | 15 | 15 | 6 | 1 | 73 | 3 | 16 | 4 | 2 | 9 | 2 |
| 17 | 58 | 6 | 33 | 14 | 7 | 1 | 19 | 4 | 14 | 1 | 1 | 8 | 2 |
| 33 | 35 | 5 | 19 | 9 | 9 | 2 | 75 | 5 | 25 | 5 | 2 | 7 | 1 |
| <hr/> | | | | | | | <hr/> | | | | | | |
| 195 | 54 | 5 | 24 | 1 | 1 | 0 | | | | | | | |

CLOTH MEASURE.

| yd. | qr. | na. | in. | EE | qr. | na. | in. |
|-------|-----|-----|-----|-------|-----|-----|-----|
| 37 | 3 | 3 | 2 | 671 | 1 | 1 | 1 |
| 61 | 3 | 1 | 1 | 161 | 3 | 3 | 2 |
| 13 | 2 | 2 | 2 | 617 | 3 | 1 | 2 |
| 32 | 1 | 1 | 1 | 178 | 3 | 2 | 1 |
| 61 | 2 | 2 | 2 | 717 | 2 | 1 | 2 |
| 22 | 1 | 3 | 0 | 166 | 3 | 2 | 1 |
| <hr/> | | | | <hr/> | | | |
| 229 | 3 | 3 | 1½ | | | | |

LAND OR SQUARE MEASURE.

| A. | R. | p. | ft. | in. | A. | R. | p. | ft. |
|-------|----|----|-----|-----|-------|----|----|-----|
| 761 | 3 | 37 | 260 | 125 | 38 | 1 | 39 | 272 |
| 131 | 2 | 16 | 135 | 112 | 61 | 3 | 38 | 167 |
| 613 | 1 | 14 | 116 | 131 | 35 | 3 | 19 | 198 |
| 161 | 3 | 13 | 116 | 123 | 47 | 3 | 16 | 271 |
| 321 | 2 | 31 | 97 | 96 | 66 | 2 | 13 | 198 |
| 47 | 3 | 19 | 91 | 48 | 46 | 1 | 14 | 269 |
| <hr/> | | | | | <hr/> | | | |
| 2038 | 1 | 13 | 2 | 95 | | | | |

SOLID MEASURE.

| Ton. | ft. | in. | cord. | ft. | in. |
|-------|-----|------|-------|-----|------|
| 29 | 36 | 1279 | 61 | 127 | 1161 |
| 69 | 19 | 1345 | 37 | 89 | 1711 |
| 67 | 18 | 1099 | 61 | 98 | 1336 |
| 71 | 14 | 1727 | 43 | 56 | 1678 |
| 43 | 35 | 916 | 91 | 119 | 1357 |
| 53 | 17 | 1719 | 81 | 115 | 1129 |
| <hr/> | | | <hr/> | | |
| 335 | 23 | 1173 | | | |

WINE MEASURE.

| Tun. | hhd. | gal. | qt. | pt. | hhd. | gal. | qt. | pt. |
|-------|------|------|-----|-----|-------|------|-----|-----|
| 61 | 3 | 62 | 3 | 1 | 67 | 15 | 3 | 1 |
| 39 | 2 | 16 | 1 | 1 | 16 | 16 | 3 | 0 |
| 68 | 3 | 57 | 2 | 1 | 39 | 16 | 3 | 0 |
| 87 | 3 | 45 | 3 | 1 | 47 | 62 | 1 | 1 |
| 47 | 2 | 59 | 3 | 1 | 43 | 57 | 3 | 0 |
| 47 | 3 | 39 | 2 | 1 | 71 | 61 | 3 | 1 |
| <hr/> | | | | | <hr/> | | | |
| 354 | 0 | 30 | 1 | 0 | | | | |

COMPOUND ADDITION.

ALE AND BEER MEASURE.

| BB. | pi. | gal. | hhd. | gal. | qt. | pt. |
|-----|-----|------|------|------|-----|-----|
| 49 | 3 | 7 | 161 | 53 | 3 | 1 |
| 61 | 2 | 5 | 371 | 52 | 3 | 1 |
| 31 | 3 | 6 | 98 | 19 | 1 | 0 |
| 42 | 1 | 5 | 47 | 43 | 1 | 0 |
| 71 | 3 | 3 | 61 | 43 | 1 | 1 |
| 68 | 1 | 3 | 42 | 27 | 3 | 1 |

326 0 2

DRY MEASURE.

| Bu. | pk. | qt. | pt. | ch. | bu. | pk. | qt. |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 37 | 3 | 5 | 1 | 16 | 31 | 2 | 3 |
| 61 | 3 | 7 | 1 | 39 | 31 | 1 | 1 |
| 32 | 2 | 2 | 0 | 14 | 16 | 3 | 1 |
| 71 | 1 | 6 | 1 | 55 | 15 | 5 | 0 |
| 61 | 1 | 3 | 1 | 71 | 17 | 3 | 1 |
| 32 | 3 | 3 | 1 | 42 | 14 | 4 | 1 |

298 0 4 1

TIME.

| y. | mo. | w. | d. | h. | m. | s. | y. | m. | d. | h. |
|----|-----|----|----|----|----|----|----|----|----|----|
| 57 | 11 | 3 | 6 | 23 | 29 | 55 | 13 | 5 | 29 | 17 |
| 31 | 11 | 1 | 3 | 19 | 19 | 39 | 61 | 11 | 17 | 21 |
| 46 | 9 | 2 | 2 | 17 | 28 | 56 | 15 | 9 | 19 | 16 |
| 43 | 10 | 1 | 1 | 18 | 17 | 48 | 61 | 10 | 25 | 23 |
| 32 | 9 | 1 | 3 | 16 | 23 | 28 | 41 | 4 | 16 | 17 |
| 14 | 1 | 1 | 5 | 22 | 28 | 16 | 18 | 5 | 9 | 6 |

227 2 0 3 21 28 2

CIRCULAR MOTION.

| S. | ° | ' | " | S. | ° | ' | " |
|----|----|----|----|----|----|----|----|
| 4 | 29 | 59 | 59 | 11 | 11 | 16 | 51 |
| 6 | 17 | 17 | 29 | 6 | 6 | 6 | 16 |
| 11 | 16 | 56 | 58 | 9 | 14 | 56 | 56 |
| 9 | 13 | 46 | 51 | 3 | 29 | 29 | 49 |
| 5 | 27 | 16 | 42 | 9 | 17 | 18 | 58 |
| 2 | 25 | 17 | 17 | 6 | 13 | 13 | 52 |

5 10 35 16

COMPOUND SUBTRACTION.

COMPOUND SUBTRACTION teaches to find the difference between numbers of different denominations.

RULE.*

Place those numbers under each other, which are of the same denomination, the less under the greater; begin with the lowest denomination, and, if it exceeds the number over it, add as many units to the upper number, as it takes of that denomination to make the next higher; then subtract and carry one to the next number of the subtrahend.

FEDERAL MONEY.

| \$ | cts. | m. | \$ | cts. | m. |
|-------|------|----|-------|------|----|
| 169 | 81 | 3 | 671 | 16 | 7 |
| 85 | 93 | 8 | 189 | 43 | 8 |
| <hr/> | | | <hr/> | | |
| 83 | 87 | 5 | | | |

ENGLISH MONEY.

| £ | s. | d. | £ | s. | d. |
|-------|----|-----------------|-------|----|-----------------|
| 87 | 16 | 3 $\frac{1}{2}$ | 617 | 11 | 5 $\frac{1}{2}$ |
| 19 | 17 | 9 $\frac{1}{2}$ | 181 | 15 | 8 $\frac{1}{2}$ |
| <hr/> | | | <hr/> | | |
| 67 | 18 | 5 $\frac{3}{4}$ | | | |

TROY WEIGHT.

| lb. | oz. | dwt. | gr. | lb. | oz. | dwt. | gr. |
|-------|-----|------|-----|-------|-----|------|-----|
| 71 | 3 | 12 | 15 | 58 | 5 | 12 | 10 |
| 16 | 10 | 17 | 20 | 19 | 9 | 17 | 21 |
| <hr/> | | | | <hr/> | | | |
| 54 | 4 | 14 | 19 | | | | |

* The reason of this rule will readily appear from what was said in simple subtraction; for the adding to the upper line depends on the same principle, and is only different, as the numbers to be subtracted are of different denominations.

COMPOUND SUBTRACTION.

APOTHECARIES' WEIGHT.

| lb. | ℥. | ʒ. | ʒ. | ʒ. | gr. | lb. | ℥. | ʒ. | ʒ. | ʒ. | gr. |
|-------|----|----|----|----|-----|-------|----|----|----|----|-----|
| 71 | 1 | 3 | 1 | 13 | | 15 | 2 | 2 | 0 | 15 | |
| 18 | 6 | 7 | 2 | 19 | | 9 | 9 | 1 | 1 | 18 | |
| <hr/> | | | | | | <hr/> | | | | | |
| 52 | 6 | 3 | 1 | 14 | | | | | | | |

AVOIRDUPOIS WEIGHT.

| T. | cwt. | qr. | lb. | oz. | dr. | cwt. | qr. | lb. | oz. |
|-------|------|-----|-----|-----|-----|-------|-----|-----|-----|
| 71 | 18 | 1 | 13 | 1 | 13 | 73 | 1 | 15 | 13 |
| 19 | 19 | 2 | 16 | 8 | 5 | 19 | 1 | 19 | 15 |
| <hr/> | | | | | | <hr/> | | | |
| 51 | 18 | 2 | 24 | 9 | 8 | | | | |

CLOTH MEASURE.

| yd. | qr. | na. | in. | EE. | qr. | na. |
|-------|-----|-----|-----|-------|-----|-----|
| 67 | 1 | 1 | 1 | 51 | 2 | 3 |
| 18 | 2 | 2 | 2 | 19 | 3 | 1 |
| <hr/> | | | | <hr/> | | |
| 48 | 2 | 2 | 1½ | | | |

LONG MEASURE.

| m. | fur. | rod. | ft. | in. | bar. | deg. | m. | fur. | rd. | yd. | ft. | in. | b. |
|-------|------|------|-----|-----|------|-------|----|------|-----|-----|-----|-----|----|
| 16 | 7 | 18 | 3 | 2 | 1 | 38 | 41 | 3 | 29 | 2 | 1 | 7 | 2 |
| 9 | 7 | 19 | 16 | 8 | 2 | 29 | 36 | 5 | 31 | 3 | 1 | 9 | 1 |
| <hr/> | | | | | | <hr/> | | | | | | | |
| 6 | 7 | 38 | 2 | 11 | 2 | | | | | | | | |

LAND OR SQUARE MEASURE.

| A. | R. | p. | ft. | in. | A. | R. | p. | yd. | ft. | in. |
|-------|----|----|-----|-----|-------|----|----|-----|-----|-----|
| 56 | 1 | 19 | 119 | 110 | 13 | 1 | 15 | 19 | 1 | 17 |
| 17 | 3 | 13 | 127 | 113 | 9 | 3 | 16 | 30 | 5 | 19 |
| <hr/> | | | | | <hr/> | | | | | |
| 38 | 2 | 5 | 264 | 33 | | | | | | |

SOLID MEASURE.

| Tons. | ft. | in. | cords. | ft. | in. |
|-------|-----|------|--------|-----|------|
| 49 | 13 | 1611 | 361 | 47 | 1178 |
| 18 | 15 | 1719 | 197 | 121 | 1617 |
| <hr/> | | | <hr/> | | |
| 30 | 37 | 1620 | | | |

COMPOUND SUBTRACTION.

53

WINE MEASURE.

| Tun. | hhd. | gal. | qt. | pt. | hhd. | gal. | qt. | pt. |
|-------|------|------|-----|-----|-------|------|-----|-----|
| 79 | 3 | 19 | 1 | 1 | 16 | 1 | 1 | 0 |
| 11 | 1 | 28 | 2 | 1 | 9 | 2 | 2 | 1 |
| <hr/> | | | | | <hr/> | | | |
| 68 | 1 | 53 | 3 | 0 | | | | |

ALE AND BEER MEASURE.

| A.B. | fir. | gal. | qt. | hhd. | gal. | qt. |
|-------|------|------|-----|-------|------|-----|
| 39 | 1 | 2 | 1 | 769 | 18 | 1 |
| 38 | 0 | 3 | 1 | 191 | 19 | 3 |
| <hr/> | | | | <hr/> | | |
| 1 | 0 | 7 | 0 | | | |

DRY MEASURE.

| Qr. | bu. | pk. | qt. | ch. | bu. | pk. | qt. |
|-------|-----|-----|-----|-------|-----|-----|-----|
| 56 | 2 | 1 | 1 | 39 | 12 | 2 | 1 |
| 38 | 3 | 1 | 2 | 12 | 25 | 3 | 5 |
| <hr/> | | | | <hr/> | | | |
| 17 | 6 | 3 | 7 | | | | |

TIME.

| mo. | d. | h. | m. | s. | y. | m. | w. | d. | h. | m. | s. |
|-------|----|----|----|----|-------|----|----|----|----|----|----|
| 6 | 16 | 13 | 27 | 19 | 48 | 9 | 2 | 5 | 19 | 27 | 31 |
| 1 | 22 | 16 | 41 | 37 | 19 | 10 | 3 | 7 | 21 | 38 | 56 |
| <hr/> | | | | | <hr/> | | | | | | |
| 4 | 23 | 20 | 45 | 42 | | | | | | | |

CIRCULAR MOTION.

| S. | ° | ' | " | S. | ° | ' | " |
|-------|----|----|----|-------|----|----|----|
| 6 | 11 | 12 | 48 | 4 | 19 | 41 | 22 |
| 9 | 8 | 15 | 56 | 1 | 22 | 19 | 28 |
| <hr/> | | | | <hr/> | | | |
| 9 | 2 | 56 | 52 | | | | |
| 5° | | | | | | | |

EXERCISES IN COMPOUND ADDITION AND SUBTRACTION.

1. What is the sum of £16, 5s. 8d. 2qr.—£31, 16s. 11d. 3qr.—£21, 11s. 1qr.—£19, 0s. 10d. 3qr.—£13, 13s. 7d. 3qr. and £28, 17s. 5d. 1qr. ? Ans. £131, 5s. 9½d.

2. Bought of a London tailor a vest for £1, 13s. 4d., a coat for £7, 12s. 9d., pantaloons for £2, 3s. 9d., and surtout for £9, 8s. 0d. ; what was the whole amount ?

Ans. £20, 17s. 10d.

3. Bought a silver tankard, weighing 1lb. 8oz. 17dwt. 14gr., a silver can, weighing 1lb. 2oz. 12dwt., a porringer, weighing 11oz. 19dwt. 20gr. and three dozen of spoons, weighing 1lb. 9oz. 15dwt. 10gr. ; what was the whole weight ?

Ans. 5lb. 9oz. 4dwt. 20gr.

4. What is the weight of a mixture of 3lb. 43. 23. 29. 14gr. of aloe, 2lb. 73. 63. 19. 13gr. of picca, and 1lb. 103. 13. 29. 17gr. of saffron ?

Ans. 7lb. 103. 33. 19. 4gr.

5. Add 32lb. 93. 13. 29. 14gr. ; 13 lb. 73. 63. 19. 13gr. ; and 16lb. 113. 73. 19. 12gr. together.

Ans. 63lb. 43. 73. 29. 19gr.

6. Sold four loads of hay ; the first weighed 27cwt. 3qr. 18lb. ; second 31cwt. 1qr. 15 lb. ; the third 19cwt. 1qr. 15lb. ; and fourth 38cwt. 2qr. 27lb. ; what is the weight of the whole ?

Ans. 117cwt. 1qr. 19lb.

7. Bought five pieces of broadcloth ; the first contained 17yd. 3qr. 2na. ; second, 13yd. 2qr. 1na. ; the third 87yd. 1qr. 3na. ; the fourth 27yd. 1qr. 2na. ; and the fifth 29yd. 1qr. 2na. ; what was the whole quantity purchased ?

Ans. 175yd. 2qr. 2na.

8. A pedestrian travelled, the first week, 371m. 3fur. 37rds. 5yd. 2ft. 10in. ; the second week, 289m. 2 fur. 18rds. 3yds. 1ft. 9 in. ; and the third week he travelled 399m. 7fur. 3ft. 11in. ; how many miles will he have travelled ?

Ans. 1060m. 5fur. 16rds. 5yds. 1ft.

9. A man has three farms ; the first contains 186A. 3R. 14p. ; the second 286A. 17p. ; and the third, 115A. 2R. ; how much do they all contain ?

Ans. 588A. 1R. 31p.

10. The Moon is 5s. 18° 14' 17" east of the Sun ; Jupiter is 7s. 10° 29' 28" east of the Moon ; Mars is 11s. 12° 11' 56" east of Jupiter ; and Herschell is 7s. 18° 38' 15" east of Mars ; what is the distance of Herschell from the Sun ?

Ans. 7s. 29° 33' 56".

11. I have four piles of wood; the first contains 7 cords, 76 feet, 1671 in.; the second 16c. 28ft. 56in.; the third 29c. 127ft. 1000in.; and the fourth 29c. 10ft. 1216in.; how much is there in all? Ans. 82c. 115ft. 992in.

12. A vinter sold at one time 73hhd. 43gal. 3qt. 1pt. of wine; at another, 27hhd. 3gal.; at another, 15hhd. 3qts. 1pt.; and, at another, 161hhd. and 2qts.; how much did he sell in all? Ans. 276 hhd. 48gal. 1qt.

13. A man has three sons; the first is 14y. 3m. 2w. 5 days old; the second is 9y. 10mo. 3w. 4da. 23h. 12m. 15sec.; and the third is 2y. 1mo. 3w. 2da. 7m.; what is the sum of their ages? And how much older is the first than the second? Ans. 26y. 2mo. 1w. 4da. 23h. 19m. 15sec.

“ 4y. 9mo. 3w. 0da. 0h. 47m. 45sec.

14. I have 73A. of land; if I should sell 5A. 3R. 1p. 7ft., how much should I have left? Ans. 67A. 0R. 38p. 265½ft.

15. A. owes B. £100; what will remain due after he has paid him 3s. 6½d.? Ans. £99, 16s. 5½d.

16. It is about 25000 miles round the globe; if a man shall have travelled 43 miles, 17 rds. 9 in. how much will remain to be travelled? Ans. 24966m. 7fur. 22rds. 15ft. 9in.

17. Bought 7 cords of wood; and 2 cords 78ft. having been stolen, how much remained? Ans. 4c. 50ft.

18. I have 15yds. of cloth; having sold 3yds. 2qr. 1na., what remains? Ans. 11yds. 0qr. 3na.

19. If a wagon loaded with hay weighs 43cwt. 2qr. 18lb., and the wagon is afterwards found to weigh 9cwt. 3qr. 23lbs., what is the weight of the hay? Ans. 33cwt. 2qr. 23lbs.

20. Bought a hogshead of wine, and by an accident 8gal. 3qts. 1pt. leaked out; what remains? Ans. 54gal. 1pt.

21. I have 10A. 3R. 10p. of land; I have sold two house-lots, one containing 1A. 2R. 13p., the other, 2A. 2R. 5p.; how much have I remaining? 5A. 2R. 23p.

22. The Moon moves 13° 10' 35" in a solar day, and the Sun 59° 8' 20"; now supposing them both to start from the same point in the heavens, how far will the Moon have gained on the Sun in 24 hours? Ans. 12° 10' 26" 40".

23. A farmer raised 136 bushels of wheat; if he sells 49 bush. 2pk. 7qt. 1pt., how much has he remaining? Ans. 86bu. 1pk. 0qt. 1pt.

24. If from a stick of round timber containing 2T. 18ft. 1410in., there be taken 38ft. 1720in., how much will be left? Ans. 1Ton, 19ft. 1418in.

25. If from 1lb. of ipecacuanna there be taken at one time 4. $\frac{3}{4}$ 23. 13gr. and at another, 3 $\frac{3}{4}$. 13. 2 ϕ . 14gr., how much will be left? Ans.. 4 $\frac{3}{4}$ 33. 2 ϕ . 17gr.

26. A brewer has in one cellar 18bbls. 1kil. 1fir. 3gal. 2qt. of beer, and in another, 13bbls. 0fir. 1pt.; what is the whole quantity, and how much more is in one cellar than the other?

Ans. 31bbls. 1kil. 1fir. 3gal. 2qt. 1pt.

" 5bbls. 1kil. 1fir. 3gal. 1qt. 1pt.

27. If from \$100.00 there be paid at one time \$17.28,5, at another time, \$10.00,5, and at another \$37.15, how much will remain? Ans. \$35.57.

28. A owes B \$86,25,8, and he owes C \$48,37,9; how much does he owe both; and how much more does he owe B than C?

Ans. he owes both \$134,63,7.

Owes B more than C \$37,87,9.

MENTAL OPERATIONS IN REDUCTION.

1. In 8 farthings how many pence? In 12? In 16? In 20? In 24? In 36? In 40? In 48?

2. How many farthings in 2 pence? In 3? In 4? In 6? In 8? In 9? In 12?

3. In 3 shillings how many pence? In 4? In 5? In 6? In 8? In 9? In 10? In 11? In 12? In 15? In 17? In 20? In 30?

4. In 24 pence how many shillings? In 36? In 48? In 60? In 72? In 84? In 90? In 100? In 120? In 150? In 180?

5. In 2 pounds how many shillings? In 4? In 5? In 6? In 8? In 10? In 20?

6. In 40 shillings how many pounds? In 60? In 80? In 120? In 160? In 200? In 240? In 300? In 360? In 400? In 480? In 500?

7. In 3s. 6d. how many pence? In 3s. 2d.? In 4s. 2d.? In 4s. 6d.? In 4s. 9d.? In 5s. 7d.? In 5s. 9d.? In 6s. 3d.? In 6s. 7d.? In 6s. 11d.? In 7s. 6d.? In 8s. 3d.? In 9s. 10d.?

8. In 2 $\frac{1}{2}$ pence how many farthings? In 3 $\frac{1}{4}$? In 4 $\frac{1}{2}$? In 5 $\frac{1}{2}$? In 6 $\frac{1}{4}$? In 7 $\frac{1}{2}$? In 9 $\frac{1}{4}$? In 10 $\frac{1}{2}$?

9. In £2 3s. how many shillings? In £2 6s.? In £5 5s.? In £5 8s.? In £6 8s.? In £10 12s.

10. In 2lbs. how many ounces? In 3lbs.? In 4lbs.? In 6? 8? In 10? In 12? In 15? In 20?

11. In 32 ounces how many pounds? In 64? In 80?
12. In 3cwt. how many quarters? In 5? In 7? In 8? In 10? In 12? In 15? In 16? In 20? In 24?
13. In 13 quarters how many cwt.? In 16? In 20? In 32? In 36? In 60?
14. In 5 tons how many cwt.? In 6? In 7? In 9? In 12? In 15? In 24?
15. In 40cwt. how many tons? In 60? In 120? In 160? In 200?
16. In 57cwt. how many tons? In 69? In 75? In 82? In 105? In 115? In 125?
17. In 5lbs. troy how many ounces? In 6? In 8? In 10? In 12? In 15? In 20?
18. In 36 ounces how many pounds troy? In 60? In 72? In 84? In 90? In 95? In 98? In 100?
19. In 7 ounces how many pennyweights? In 8? In 10? In 12? In 14? In 16? In 28?
20. In 40 grains how many pennyweights? In 50? In 60? In 70? In 90? In 120?
21. In 7 scruples how many grains? In 8? In 9?
22. In 40 grains how many scruples? In 50? In 60? In 70? In 80? In 100?
23. In 2 yards how many quarters? In 3? In 5? In 10? In 12? In 15? In 16? In 20?
24. In 3 ells English how many quarters? In 7? In 12? In 16?
25. In 12 quarters how many yards? In 16? In 19? In 24? In 30? In 36?
26. In 6 quarters how many nails? In 6? In 7? In 8? In 12?
27. In 24 nails how many quarters? In 30? In 36? In 40? In 46? In 50? In 70? In 100?
28. In 100 pence how many shillings? In 144? In 160?
29. In 140 shillings how many pounds?
30. In 96 ounces how many lbs.?
31. In 56 lbs. how many quarters? In 84? In 112?
32. In 8 quarters how many cwt.? In 12? In 16? In 28? In 44? In 48?
33. In 40 cwt. how many tons? In 80? In 100? In 120? In 180? In 200? In 800?
34. In 48 qrs. how many dwt.? In 72? In 96? In 144?
35. In 9 scruples how many drams? In 12? In 18?
36. In 48 ounces, troy, how many lbs.? In 96? In 144?

37. In 12 quarters how many lbs. ? In 16 ? In 28 ? In 40 ?
In 48 ? In 56 ? In 60 ? In 100 ?

38. In 25 quarters how many ells English ? In 30 ? In 60 ?
In 70 ? In 100 ?

39. In 36 inches how many feet ? In 48 ? In 60 ? In 144 ?
In 80 ? In 90 ? In 100 ? In 120 ?

40. In 12 feet how many yards ? In 15 ? In 24 ? In 30 ?
In 48 ? In 60 ? In 66 ? In 90 ?

41. In 80 rods how many furlongs ? In 120 ? In 720 ?

42. In 24 furlongs how many miles ? In 32 ? In 48 ? In
72 ?

43. In 3 weeks how many days ? In 4 ? In 5 ? In 6 ? In 7 ?
In 8 ? In 9 ? In 12 ? In 14 ? In 20 ? In 25 ? In 30 ? In 50 ?
In 60 ? In 100 ?

44. In 5 years how many months ? In 3 ? In 4 ? In 8 ? In
9 ? In 10 ? In 12 ? In 24 ?

45. In 2 quarts how many pints ? In 4 ? In 6 ? In 8 ? In
10 ? In 20 ? In 50 ? In 60 ? In 100 ?

46. In 5 years how many months ? In 3 ? In 4 ? In 8 ? In
9 ? In 10 ? In 12 ? In 24 ?

47. In 2 quarts how many pints ? In 4 ? In 6 ? In 8 ? In
10 ? In 20 ? In 50 ?

48. In 3 gallons how many quarts ? In 4 ? In 5 ? In 6 ? In
8 ? In 9 ? In 10 ? In 20 ? In 40 ? In 50 ? In 100 ?

49. In 2 hogsheads how many gallons ? In 3 ? In 4 ? In
5 ? In 6 ? In 7 ? In 8 ? In 10 ?

50. In 3 pipes how many hogsheads ? In 5 ? In 7 ? In 8 ?
In 10 ? In 12 ? In 20 ?

51. In 2 tuns how many hogsheads ? In 5 ? In 7 ? In 8 ?
In 9 ? In 10 ? In 12 ?

52. In 2 bushels how many pecks ? In 3 ? In 4 ? In 5 ? In
6 ? In 8 ? In 10 ? In 15 ? In 20 ? In 60 ?

53. In 3 pecks how many quarts ? In 4 ? In 5 ? In 10 ? In
12 ? In 15 ? In 20 ? In 25 ? In 30 ?

54. In 2 feet how many square inches ? In 4 ? In 5 ? In
10 ? In 20 ? In 50 ?

55. In 3 square yards how many feet ? In 4 ? In 6 ? In 7 ?
In 8 ? In 10 ? In 40 ?

56. In 5 roods how many rods ? In 10 ? In 20 ?

57. In 2 acres how many rods ? In 5 ? In 10 ? In 20 ? In
30 ? In 40 ? In 50 ? In 100 ?

58. In 3 acres how many rods ? In 5 ? In 10 ? In 50 ?

59. In 5 minutes how many seconds ? In 10 ? In 20 ?

60. In 2 hours how many minutes? In 3? In 4? In 5?
In 8? In 12? In 15? In 20? In 30? In 35?
61. In 3 days how many hours? In 5? In 6? In 8? In
10? In 15? In 20? In 25? In 50? In 100?
62. In 2 cents how many mills? In 3? In 4? In 6? In 8?
In 9? In 12? In 16? In 18? In 25? In 35?
63. In 20 mills how many cents? In 30? In 40? In 60?
In 70? In 80? In 90? In 100?
64. In 3 dimes how many cents? In 5? In 7? In 9? In
10? In 12?
65. In 30 cents how many dimes? In 50? In 100?
66. In 2 dollars how many cents? In 5? In 6? In 7? In
10? In 20? In 30? In 50? In 100?
67. In 300 cents how many dollars? In 400? In 500? In
600? In 800? In 900? In 1000?
68. In 5 eagles how many dollars? In 6? In 10? In 20?
In 25? In 35? In 75? In 100?
69. In 20 dollars how many eagles? In 30? In 50? In
70? In 100? In 200? In 1000?

REDUCTION.

THE object of this rule is to change numbers of one denomination to another without losing their value.

It consists of two parts, Descending and Ascending. The former is performed by Multiplication, the latter by Division.

Reduction Descending teaches to bring numbers of a higher denomination to a lower; as, to bring pounds into shillings, or tons into hundred weights.

Reduction Ascending teaches to bring numbers of a lower denomination into a higher; as, to bring farthings into pence, or shillings into pounds.

REDUCTION DESCENDING.

RULE.

Multiply the highest denomination given by so many of the next less as will make one of that greater; and so proceed until it is brought down to the denomination required, observ-

ing to bring in the lower denominations to their respective places.

EXAMPLES.

1. In £48 12s. 7d. 2qr. how many farthings.

$$\begin{array}{r}
 \text{£}48 \text{ 12s. 7d. 2qr.} \\
 20 \\
 \hline
 972 + 12 \\
 12 \\
 \hline
 11671 + 7 \\
 4 \\
 \hline
 46686 + 2
 \end{array}$$

In this example, we multiply the £48 by 20, because it takes twenty shillings to make a pound; and to this product we add the twelve shillings in the question. Then multiply by 12, because it takes twelve pence to make one shilling; and, to the product we add the 7 pence in the question. We then multiply by 4, the

number of farthings in a penny, and, to the product, we add the 2 farthings, and the work is done.

2. In £127 15s. 8d. how many farthings?

Ans. 122672.

3. In £28 19s. 11d. 3qr. how many farthings?

Ans. 27839.

4. In £378 how many pence?

Ans. 90720.

5. How many grains in 28lb. 11oz. 12dwt. 15gr. troy?

Ans. 166862.

6. In 17lb. 12dwt. troy, how many grains?

Ans. 4092.

7. If a silver tankard weigh 3lb. 11oz. how many grains will it be?

Ans. 22080.

8. How many scruples in 23lbs., apothecaries' weight?

Ans. 6624.

9. If a load of hay weigh 3T. 16cwt. 2qr. 19lbs. how many ounces will it be?

Ans. 137376.

10. Required the number of drachms in a hoghead of sugar, weighing 2T. 17cwt. 3qr. 16lb. 15oz. 13dr.?

Ans. 1660157.

11. In 57yds. how many nails?

Ans. 912.

12. In 83947 E.E. 4qr. how many nails?

Ans. 1678956.

13. In 2263 E.F. 2qr. how many quarters?

Ans. 6791.

14. How many feet in 79 miles?

Ans. 417120.

15. How many inches in 396 furlongs?

Ans. 3136320.

16. How many inches from Haverhill to Boston, the distance being 30 miles? Ans. 1900800.

17. How many barleycorns will it take to reach round the world? Ans. 4755801600.

18. In 403m. 7fur. 35rd. 2yd. 0ft. 0in. 1bar. how many barleycorns? Ans. 76789567.

19. In 413Le. 2m. 2fur. 38rd. 1yd. 0ft. 7in. how many inch.? Ans. 78653167.

20. In 144m. 1fur. 8rd. 1yd. 1ft. how many feet? Ans. 761116.

21. How many inches in 1051yd. 2ft. 5 in.? Ans. 37865.

22. In 3576fur. 12rd. 3yd. how many yards? Ans. 786789.

23. How many square feet in 25 acres? Ans. 1089000.

24. How many square rods in 365 square miles? Ans. 37376000.

25. The surface of the earth contains 196563942 square miles. What would it be in square inches?

Ans. 789,103,900,894,003,200.

26. Required the number of inches in 10A. 3R. 38p. 6yd. 5ft. 72 in. Ans. 478675 feet.

27. In 2r. 0p. 24yd. 3ft. how many inches? Ans. 3167856.

28. In 1A. 3R. 34p. 27yd. 4ft. 54in. how many inches? Ans. 12345678.

29. In 17 cords of wood how many inches? Ans. 3760128.

30. In 19 tons of round timber how many inches? Ans. 1313208.

31. How many cubic feet of wood in 128 cords? Ans. 16384.

32. In 4899hhd. 4galls. 3qt. how many quarts? Ans. 1234567.

33. In 1224 tons, 1p. 1hhd. 19galls. 1qt. 0pt. 1gi. how many gills? Ans. 9877001.

34. How many pints in 790p. 0hhd. 58 galls. 0qt. 1pt.? Ans. 796785.

35. In 460 butts, 1hhd. 31 galls. of beer, how many galls.? Ans. 49765.

36. In 235bar. 26galls. 3qt. 1pt. how many pints? Ans. 6789567.

37. In 16 tons of round timber, how many inches? Ans. 1105920.

38. How many seconds since the deluge, it being 2348 years
B. C. ? Ans.
39. How many days did the last war continue ? Ans. 609.
40. How many pecks in 676 chaldrons ? Ans. 97344.
41. In 657 cents how many mills ? Ans. 6570.
42. In 3165 dimes how many mills ? Ans. 316500.
43. In 63 dollars, how many cents ? Ans. 6300.
44. In 27 eagles, how many mills ? Ans. 270000.

REDUCTION ASCENDING.

RULE.

Divide the lowest denomination given by that number, which it takes of that denomination to make one of the next higher ; so proceed, until it is brought to the denomination required.

EXAMPLES.

1. In 76789 farthings, how many pounds ? Ans. 79£ 19s. 9½d.

$$\begin{array}{r}
 4 \overline{)76789} \\
 \underline{12)19197-1} \\
 \underline{20)1599-9} \\
 79-19-9-\frac{1}{4}
 \end{array}$$

2. In 61786574 farthings, how many pounds ? Ans. 64361£ 0s. 3½d.
3. In 367895 pence, how many shillings ? Ans. 30657s. 11d.
4. In 12345678 grains troy, how many pounds ? Ans. 2143 lbs. 4 oz. 3 dwt. 6 grs.
5. In 56389 dwt. how many ounces ? Ans. 2819 oz. 9 dwt.
6. In 166862 grains troy, how many pounds ? Ans. 28 lbs. 11 oz. 12 dwt. 14 grs.

7. How many pounds apothecaries' weight, are contained in 6624 scruples? Ans. 23 lbs.
8. In 691785 grains apothecaries' weight, how many pounds? Ans. 120 lbs. 13. 13. 29. 5 grs.
9. How many tons in 137376 ounces? Ans. 3 tons. 16 cwt. 2 qrs. 8 lbs.
10. How many hundred weight in 617816 lbs? Ans. 5516 cwt. 0 qr. 24 lbs.
11. How many yards in 912 nails? Ans. 57.
12. In 1678956 nails, how many ells English? Ans. 83947 E.E. 4 qrs.
13. In 6791 quarters, how many ells Flemish? Ans. 2263 E.F. 2 qrs.
14. How many miles in 417120 feet? Ans. 79.
15. How many furlongs in 3136320 inches? Ans. 396.
16. In 76789567 barleycorns, how many miles? Ans. 403 m. 7 fur. 35 rds. 2 yds. 0 ft. 0 in. 1 bar.
17. In 78653167 inches, how many leagues? Ans. 413 lea. 2 m. 2 fur. 38 rds. 1 yd. 0 ft. 7 in.
18. How many miles in 761116 feet? Ans. 144 m. 1 fur. 8 rds. 1 yd. 1 ft.
19. How many yards in 37865 inches? Ans. 1051 yds. 2 ft. 5 in.
20. In 786789 yards how many furlongs? Ans. 3576 fur. 12 rds. 3 yds.
21. Required the number of acres in 478675 square feet. Ans. 10 acr. 3 R. 38 fur. 6 yds. 5 ft. 72 in.
22. Required the number of roods in 3167856 inches. Ans. 2 R. 0 fur. 24 yds. 3 ft.
23. Required
24. In 12345678 inches, how many acres? Ans. 1 A. 3 R. 34 fur. 27 yds. 4 ft. 54 in.
25. The surface of the earth contains 789103900894003200 square inches; what would it be in square miles? Ans. 196563942.
26. In 1234567 quarts of wine, how many hogsheds? Ans. 4899 hhds. 4 galls. 3 qts.
27. In 9877001 gills, how many tuns? Ans. 1224 tuns. 1 p. 1 hhd. 19 galls. 1 qt. 0 pt. 1 gi.
28. In 796785 pints, how many pipes? Ans. 799 P. 0 hhd. 58 galls. 0 qt. 1 pt.
29. In 49765 gallons of beer, how many butts? Ans. 460 b. 1 hhd. 31 galls.

30. In 31100 quarts, how many hogsheds ?
 Ans. 143 hhds. 53 gals.
31. How many barrels in 6789567 pints ?
 Ans. 235 bls. 26 gals. 3 qts. 1 pt.
32. In 78678 cubic inches, how many feet ?
 Ans. 45 ft. 918 in.
33. In 67897 cubic feet, how many cords ?
 Ans. 530 cords. 57 ft.
34. How many tuns of round timber in 7671676 inches ?
 Ans. 110 tuns. 39 ft. 1084 in.
35. How many bushels in 767161 pints ?
 Ans. 11986 bu. 3 pk. 2 galls. 1 pt.
36. How many chaldrons in 123456 quarts ?
 Ans. 107 chal. 6 bu.
37. How many days in 7678901 minutes ?
 Ans. 5332 da. 13 h. 41 m.
38. How many years in 7166789 seconds ?
 Ans. 2 yrs. 93 da. 4 h. 33 m. 9 s.
39. If it takes 16 cubic feet to make one foot cord measure, and 8 feet cord measure to make one cord; how many cords are in 1616 cubic feet ?
 Ans. 12 cords. 5 ft.
40. In 3232 cubic feet, how many cords ?
 Ans. 25 cords. 2 ft.
41. In 76589 cents, how many dollars ?
 Ans. 765 dolls. 89 cts.
42. In 676 mills, how many cents ?
 Ans. 67 cts. 6 mills.
43. In 612345 mills, how many eagles ?
 Ans. 61 ea. 2 dolls. 34 cts. 5 mills.
44. In 75 dimes how many dollars ?
 Ans. 7 dolls. 5 dimes.

COMPOUND REDUCTION.

1. In 57£ 15s. how many dollars ?
 Ans. 192 dolls. 50 cts.
2. In 67£ 14s. 9d. how many crowns at 6s. 7d. each ?
 Ans. 205 cr. 5 s. 2 d.
3. How many pounds, shillings, and pence in 678 dollars ?
 Ans. 203£ 8s.

4. How many ells English in 761 yards?

Ans. 603 yds. 4 qrs.

5. How many yards in 61 ells Flemish?

Ans. 45 yds. 3 qrs.

6. How many bottles that contain 3 pints each will it take to hold a hogshead of wine?

Ans. 168.

7. How many steps, 2 ft. 8 inch. each, will a man take in walking from Bradford to Newburyport, the distance being 15 miles?

Ans. 2970.

8. How many spoons, each weighing 2 oz. 12 dwt. can be made from 5 lbs. 2 oz. 8 dwt. of silver.

Ans. 24 spoons.

9. How many times will the wheel of a coach revolve, whose circumference is 14 feet, 9 inches, in passing from Boston to Washington, the distance being 436 miles?

Ans. 468219 $\frac{1}{17}$.

10. I have a field of corn, consisting of 123 rows, and each row contains 78 hills, and each hill has 4 ears of corn; now if it take 8 ears of corn to make a quart, how many bushels does the field contain?

Ans. 149 bu. 3 pks. 7 qts. 2 pts.

11. If it take 5 yds. 2 qrs. 3 na. to make a suit of clothes, how many suits can be made from 182 yards?

Ans. 32.

12. A goldsmith wishes to make a number of rings, each weighing 5 dwt. 10 gr. from 3 lb. 1 oz. 2 dwt. 2 grs. of gold; how many will there be?

Ans. 137 rings.

13. How many shingles will it take to cover the roof of a building, which is 60 feet long and 56 feet wide, allowing each shingle to be four inches wide and 18 inches long, and to lay one third to the weather?

Ans. 20160.

14. There is a house 56 feet long; and each of the two sides of the roof is 25 feet wide. How many shingles will it take to cover it, if it require 6 shingles to cover a square foot?

Ans. 16800 shingles.

15. If a man can travel 22 miles, 3 furlongs, 17 rods a day, how long would it take him to walk round the globe, the distance being about 25000 miles?

Ans. 1115 days.

16. If a family consume 7 lbs. 10 oz. of sugar in a week, how long would 10 cwt. 3 qrs. 16 lbs. last them?

Ans. 160 weeks

17. Sold 3 tons, 17 cwt. 3 qrs. 18 lbs. of lead at 7d. a pound, what did the lead amount to?

Ans. 254£ 10s. 2d.

18. What will 5 cwt. 1 qr. 10 lbs. of tobacco cost, at 4½d a pound?

Ans. 11£ 4s. 3d.

19. What will 7 hogsheads of wine cost, at 9 cents a quart?

Ans. 158 dolls. 76 cts.

20. What will 15 hogsheads of beer cost, at 3 cents a pint?

Ans. 194 dolls. 40 cts.

21. What will 73 bushels of meal cost, at 2 cents a quart?

Ans. 46 dolls. 72 cts.

22. A merchant has 29 bales of cotton cloth; each bale contains 57 yards. What is the value of the whole at 15 cents a yard?

Ans. 204 dolls. 45 cts.

23. A merchant bought 4 bales of cotton; the first contained 6 cwt. 2 qrs. 11 lbs.; the second, 5 cwt. 3 qr. 16 lbs.; the third, 7 cwt. 0 qr. 7 lbs.; the fourth, 3 cwt. 1 qr. 17 lbs. He sold the whole at 15 cents a pound. What did it amount to?

Ans. 385 dolls. 65 cts.

24. A merchant having purchased 12 cwt. of sugar, sold at one time 3 cwt. 2 qrs. 11 lbs. and at another time he sold 4 cwt. 1 qr. 15 lbs. What is the remainder worth at 15 cents per pound?

Ans. 67 dolls. 50 cts.

25. Bought 4 chests of hyson tea. The weight of the first was 2 cwt. 1 qr. 7 lbs.; the second, 3 cwt. 2 qrs. 15 lbs.; the third, 2 cwt. 0 qr. 20 lbs.; the fourth, 5 cwt. 3 qrs. 17 lbs. What is the value of the whole at $37\frac{1}{2}$ a pound?

Ans. 589 dolls. $12\frac{1}{2}$ cts.

26. Purchased a cargo of molasses, consisting of 87 hogsheads. What is the value of it at 33 cents a gallon?

Ans. 1808 dolls. 73 cts.

27. From a hogshead of wine, 10 galls. 1 qt. 1 pt. 3 gills leaked out. The remainder was sold at 6 cents a gill. To what did it amount?

Ans. 100 dolls. 86 cts.

28. A man has 3 farms; the first containing 100 acres, 3 R. 15 rds.; the second, 161 acres, 2 R. 28 rds.; the third, 360 acres, 3 R. 5 rds. He gave his oldest son a farm of 112 acres, 3 R. 30 rds.; his second son a farm of 316 acres, 1 R. 18 rds.; his youngest son a farm of 168 acres, 3 R. 13 rds.; and sold the remainder of his land at 1 dollar and 35 cents a rod. To what did it amount?

Ans. 5436 dolls. 45 cts.

29. A grocer bought a hogshead of molasses, containing 87 galls. 1 qt. from which 13 gallons leaked out. What is the remainder worth at a cent a gill?

Ans. 23 dolls. 76 cts.

30. A man bought 4 loads of hay; the first weighing 25 cwt. 0 qr. 17 lbs.; the second, 37 cwt. 2 qrs. 17 lbs.; the

third, 18 cwt. 3 qrs. 14 lbs.; and the fourth, 37 cwt. 1 qr. 17 lbs. What is the value of the whole, at 2 cents a pound?

Ans. 266 dolls. 74 cts.

REDUCTION OF THE OLD NEW-ENGLAND CURRENCY TO FEDERAL MONEY.

RULE.

To the pounds annex three ciphers, and divide the number by 3, and the quotient will be the answer in cents; but if there be pounds and shillings, annex to the pounds half the number of shillings and two ciphers; and if the shillings be an odd number, instead of two ciphers, annex a 5 and a cipher, and divide the number by 3, and the quotient will be the answer in cents, as before; if there be pounds, shillings, pence and farthings, let the pounds and shillings be arranged as before, then reduce the pence and farthings into farthings, and add 1 if their number exceed 12, and 2 if it exceed 36, and let them be so annexed to the pounds, that the units of the farthings shall possess the third place from the pounds; then divide by 3, as before, and the quotient is cents.

NOTE.—As a dollar is six twentieths of a pound, or, which is the same thing, three tenths, therefore a pound is ten thirds of a dollar. It is also evident, that if pounds be multiplied by 10, their product will be thirds of a dollar; and if thirds of a dollar be divided by 3, the quotient will be dollars. Again, as shillings are twentieths of a pound, it is evident that if they be halved, they become tenths or decimals of a pound; and if 1 be added to 24 farthings, or 2 be added to 48 farthings, and they be made to occupy the third place from pounds, they become decimals also; for twenty-four farthings are twenty-four nine hundred sixtieths of a pound; but if 1 be added to the numerator of this fraction, then must 40 be added to the denominator, to make a fraction of equal value, for twenty-four nine hundred sixtieths is equal to twenty-five one thousandths; now, if a pound be considered the unit, twenty-five thousandths will be expressed thus, .025£. Therefore, as the number of farthings may be less or greater than 24, so a greater or less number than a unit must be added to their number. Q. E. D.

1. Reduce 162£ to Federal Money.

3)162000

54000

Ans. 540 dolls.

2. Change 319£ 17s. to Federal Money.

3)319850

 106616 $\frac{2}{3}$
Ans. 1066 dols. 16 $\frac{2}{3}$ cts.3. Change 176£ 17s. 8 $\frac{1}{2}$ d. to Federal Money.

176850

36

 3)176886

58962

Ans. 589 dols. 62 cts.

| | | | | | | |
|-----|--------|------|----------------------------|----------------|------|-----------------------|
| 4. | Reduce | 315£ | to | Federal Money. | Ans. | \$1050 00 |
| 5. | " | 619£ | to | " | " | 2063 33 $\frac{1}{3}$ |
| 6. | " | 166£ | to | " | " | 553 33 $\frac{1}{3}$ |
| 7. | " | 318£ | to | " | " | 1060 00 |
| 8. | " | 101£ | to | " | " | 336 66 $\frac{2}{3}$ |
| 9. | " | 144£ | to | " | " | 480 00 |
| 10. | " | 161£ | 18s. to | " | " | 539 66 $\frac{2}{3}$ |
| 11. | " | 361£ | 17s. to | " | " | 1206 50 |
| 12. | " | 99£ | 11s. to | " | " | 331 83 $\frac{1}{3}$ |
| 13. | " | 100£ | 9s. to | " | " | 333 83 $\frac{1}{3}$ |
| 14. | " | 661£ | 7s. to | " | " | 2204 50 |
| 15. | " | 47£ | 11s. to | " | " | 158 50 |
| 16. | " | 109£ | 1s. to | " | " | 363 50 |
| 17. | " | 16£ | 17s. 6 $\frac{1}{2}$ d. to | " | " | 52 25 $\frac{2}{3}$ |
| 18. | " | 69£ | 1s. 3 $\frac{1}{4}$ d. to | " | " | 230 21 |
| 19. | " | 87£ | 16s. 11d. to | " | " | 292 82 $\frac{2}{3}$ |
| 20. | " | 14£ | 7s. 7 $\frac{1}{2}$ d. to | " | " | 47 93 $\frac{2}{3}$ |
| 21. | " | 73£ | 3s. 4 $\frac{1}{2}$ d. to | " | " | 243 89 $\frac{2}{3}$ |
| 22. | " | 47£ | 12s. 10d. to | " | " | 158 80 $\frac{2}{3}$ |
| 23. | " | 187£ | 5s. 0 $\frac{3}{4}$ d. to | " | " | 624 17 $\frac{2}{3}$ |
| 24. | " | 10£ | 0s. 3 $\frac{1}{4}$ d. to | " | " | 33 38 |

MULTIPLICATION OF FEDERAL MONEY.

RULE.

When the price is in cents, or dollars and cents, multiply the quantity by the price, and the answer is in cents, which may be reduced to dollars and cents by cutting off *two* figures from the right hand, which are cents; and those at the left are dollars. If the price be in mills, or cents and mills, or dollars, cents and mills, multiply as before, and cut off *three* figures from the right hand, the unit of which is mills, the other two are cents; and those figures at the left hand are dollars.

EXAMPLES.

1. What will 365 barrels of Genessee flour cost, at 5 dollars 75 cents a barrel?

$$\begin{array}{r}
 365 \\
 575 \\
 \hline
 1825 \\
 2555 \\
 1825 \\
 \hline
 \$2098,75
 \end{array}$$

2. What will 128 pounds of sugar cost, at 13 cents, 7 mills a pound?

$$\begin{array}{r}
 128 \\
 137 \\
 \hline
 896 \\
 384 \\
 128 \\
 \hline
 \$17,53,6
 \end{array}$$

3. What will 126 pounds of butter cost, at 13 cents a pound?

Ans. 16 dolls. 38 cts.

4. What will 63 pounds of tea cost, at 93 cents a pound?

Ans. 58 dolls. 59 cts.

5. What will 43 tons of hay cost, at 13 dollars seventy-five cents a ton?

Ans. 571 dolls. 25 cts.

6. If 1 pound of pork is worth 7 cents 3 mills, what is 46 pounds worth?

Ans. 3 dolls. 33 cts. 8 mills.

7. If 1 hundred weight of beef cost 3 dollars 28 cents, what is 76 hundred weight worth? Ans. 249 dolls. 28 cts.

8. What will 96 thousand feet of boards cost, at 11 dollars 67 cents a thousand? Ans. 1120 dolls. 32 cts.

9. If a barrel of cider be sold for 2 dollars 12 cents, what will be the value of 169 barrels? Ans. 358 dolls. 28 cts.

10. What will be the value of a hogshead of wine, containing 63 gallons, at 1 dollar 63 cents a gallon?

Ans. 78 dolls. 75 cts.

11. Sold a sack of hops weighing 396 pounds, at 11 cents 3 mills a pound; to what did it amount?

Ans. 44 dolls. 74 cts. 8 mills.

12. Sold 19 cords of wood, at 5 dollars 75 cents a cord; to what did it amount?

Ans. 109 dolls. 25 cts.

13. Sold 169 tons of timber, at 4 dollars 68 cents a ton; what did I receive?

Ans. 790 dolls. 92 cts.

14. Sold a hogshead of sugar weighing 465 pounds; to what did it amount, at 14 cents a pound?

Ans. 65 dolls. 10 cts.

15. What will be the amount of 789 pounds of leather, at 18 cents a pound?

Ans. 142 dolls. 2 cts.

16. What will be the expense of 846 pounds of sheet lead, at 5 cents 7 mills a pound?

Ans. 48 dolls. 22 cts. 2 mills.

17. When potash is sold for 132 dolls. 55 cts. a ton, what will be the price of 369 tons?

Ans. 48910 dolls. 95 cts.

18. What will 365 pounds of bees' wax cost, at 18 cents 4 mills a pound?

Ans. 67 dolls. 16 cts.

19. If 1 pound of tallow cost 7 cents 3 mills, what is 968 pounds worth?

Ans. 70 dolls. 66 cts. 4 mills.

20. What will a chest of souchong tea be worth, containing 69 pounds, at 29 cents 9 mills a pound?

Ans. 20 dolls. 63 cts. 1 mill.

21. If 1 drum of figs cost 2 dollars 75 cents, what will be the price of 79 drums?

Ans. 217 dolls. 25 cts.

22. If 1 box of oranges cost 6 dollars 71 cents, what will be the price of 169 boxes?

Ans. 1133 dolls. 91 cts.

23. Purchased 796 pounds of cocoa, at 11 cents 4 mills a pound; what did I have to pay?

Ans. 90 dolls. 74 cts. 4 mills.

24. A farmer sold 691 bushels of wheat, at 1 dollar 25 cents a bushel; what did he receive for it?

Ans. 863 dolls. 75 cts.

25. What is 97 pounds of madder worth, at 17 cents 6 mills a pound?

Ans. 17 dolls. 7 cts. 2 mills.

26. A merchant sold 73 hogsheads of molasses, each containing 63 gallons, for 44 cents a gallon; how much money did he receive? Ans. 2023 dolls. 56 cts.

27. A drover has 169 sheep, which he values at 2 dollars 69 cents a head; what is the value of the whole drove? Ans. 554 dolls. 61 cts.

28. A farm containing 144 acres, is valued at 69 dollars, 74 cents, 8 mills an acre; what is the amount of the whole? Ans. 1043 dolls. 71 cts. 2 mills.

29. An auctioneer sold 48 bags of cotton, each containing 397 pounds, at 13 cents 7 mills a pound; what is the value of the whole? Ans. 2610 dolls. 67 cts. 2 mills.

30. If one yard of broadcloth cost 5 dollars 67 cents, what will be the value of 48 yards? Ans. 270 dolls. 16 cts.

31. A wool grower has 179 sheep, each producing 4 pounds of wool; what will be its value, at 59 cents 3 mills a pound? Ans. 424 dolls. 58 cts. 8 mills.

32. A house having 17 rooms, requires 6 rolls of paper for each room; now if each roll costs 1 dollar 17 cents, what will be the expense for all the rooms? Ans. 119 dolls. 34 cts.

33. What will 39 yards of brown sheeting cost, at 17 cents a yard? Ans. 15 dolls. 13 cts.

34. What will 47 thousand of shingles cost, at 3 dollars 75 cents a thousand? Ans. 176 dolls. 25 cts.

35. Bought 47 hogsheads of salt, each containing 7 bushels, for 1 dollar 12 cents a bushel; what did it cost? Ans. 421 dolls. 12 cts.

36. What will a ton of hay cost, at 1 dollar 17 cents a hundred weight? Ans. 23 dolls. 40 cts.

37. If one foot of wood cost 63 cents, what will 39 cords cost? Ans. 196 dolls. 56 cts.

38. What will 163 buckets cost, at 1 dollar 21 cents a bucket? Ans. 203 dolls. 23 cts.

39. What will 78 barrels of shad cost, at 3 dollars 89 cents a barrel? Ans. 303 dolls. 42 cts.

40. If 1 pound of salmon cost 17 cents 5 mills, what will 789 pounds cost? Ans. 138 dolls. 7 cts. 5 mills.

41. Bought 163 grindstones, at 6 dollars 79 cents each; what did the whole cost? Ans. 1106 dolls. 77 cts.

42. Sold 49 green hides, at 1 dollar 95 cents each; what did they all amount to? Ans. 95 dolls. 55 cts.

43. If a man's wages be 1 dollar 19 cents a day, what are they for a year? Ans. 434 dolls. 35 cts.

44. Hired a horse and chaise to go a journey of 146 miles, at 16 cents a mile; what did it cost?

Ans. 23 dolls. 36 cts.

45. If it be worth 3 dollars 68 cents to plough one acre of land, what would it be worth to plough 79 acres?

Ans. 290 dolls. 72 cts.

46. What will 148 tons of plaster of Paris cost, at 2 dollars 28 cents a ton?

Ans. 337 dolls. 44 cts.

47. Bought 79 tons of logwood, at 49 dollars 75 cents a ton; what did it cost?

Ans. 3930 dolls. 25 cts.

48. Bought 5 gross bottles of castor oil, at 37 cents a bottle; what did it cost?

Ans. 266 dolls. 40 cts.

49. Sold 19 dozen pair of men's gloves, at 47 cents a pair; to what did they amount?

Ans. 107 dolls. 16 cts.

50. Bought a hogshead of wine for 97 cents a gallon, and sold it for 1 dollar 75 cents a gallon; what did I gain?

Ans. 49 dolls. 14 cts.

51. Bought 75 barrels of flour, at 5 dollars 75 cents a barrel, and sold it at 6 dollars 37 cents; what did I gain?

Ans. 46 dolls. 50 cts.

52. Bought 17 score of penknives, at 17 cents each; what did they all cost?

Ans. 57 dolls. 80 cts.

COMPOUND MULTIPLICATION.

CASE I.

RULE.—When the quantity is less than 12, multiply the price by the quantity, and carry as in Compound Addition.

EXAMPLES.

1. Multiply £7 12s. 7d.
by 6

44 15 6

Ans. £44 15s. 6d.

2. Multiply £18 16s. 7½d. by 4. Ans. £75 6s. 6d.
3. Multiply £15 11s. 8½d. by 8. Ans. £124 13s. 10d.
4. Multiply £27 19s. 11½d. by 9. Ans. £251 19s. 7½d.
5. Multiply £19 5s. 7½d. by 11. Ans. £212 1s. 7½d.
6. Multiply £31 14s. 9d. by 8. Ans. £653 18s. 0d.
7. Multiply £15 18s. 5d. by 7. Ans. £111 8s. 11d.
8. Multiply £13 5s. 4½d. by 12. Ans. £159 4s. 9d.
9. Multiply 17lb. 7oz. 13dwt. 13gr. by 9.
 Ans. 158lb. 9oz. 1dwt. 21gr.
10. Multiply 15lb. 11oz. 19dwt. 15gr. by 7.
 Ans. 111lb. 11oz. 17dwt. 9gr.
11. Multiply 16T. 12cwt. 3qr. 13lb. 12oz. by 11.
 Ans. 183T. 2qr. 11lb. 4oz.
12. Multiply 13T. 3cwt. 1qr. 14lb. 13oz. by 8.
 Ans. 105T. 7cwt. 0qr. 6lb. 8oz.
13. Multiply 47yds. 3qr. 2na. 2in. by 7.
 Ans. 335yds. 2qr. 0na. 0½in.
14. Multiply 17m. 7fur. 36rds. 13ft. 7in. by 12.
 Ans. 215m. 7fur. 1rd. 14ft. 6in.
15. Multiply 16deg. 39m. 3fur. 39rds. 5yds. 2ft. by 9.
 Ans. 149deg. 8m. 0fur. 0rds. 1yd. 1ft. 6in.
16. Multiply 39A. 3R. 17p. 30yd. 8 ft. 100in. by 8.
 Ans. 318A. 3R. 24p. 5yd. 6ft. 80in.
17. Multiply 16A. 2R. 4p. 19yd. 7ft. 79in. by 11.
 Ans. 181A. 3R. 11p. 6yd. 4ft. 41in.
18. Multiply 7 cord 116ft. 1629in. by 4.
 Ans. 31 cord 83ft. 1332in.
19. Multiply 29hhd. 61gal. 3qt. 1pt. 3gi. by 7.
 Ans. 20hhd. 10gal. 3qt. 0pt. 1gi.

20. Multiply 3 Tun. 3hhd. 56gal. 2qt. by 9.
 Ans. 3 Tun. 3hhd. 4gal. 2qt.
21. Multiply 7bar. 1kil. 0fir. 5gal. 2qt. 1pt. by 8.
 Ans. 61bbl. 0kil. 1fir. 5gal. 0qt. 0pt.
22. Multiply 19bu. 2pk. 7qt. 1pt. by 6.
 Ans. 119bu. 1pk. 5qt. 0pt.
23. Multiply 36chald. 18bu. 3pk. 7qt. by 7.
 Ans. 255chald. 24bu. 3pk. 1qt.
24. Multiply 13y. 316da. 15h. 27m. 39sec. by 8.
 Ans. 110y. 343da. 3h. 41m. 12sec.

CASE II.

When the quantity is more than 12, and can be produced by multiplying two or more numbers,

RULE.—Multiply the price or quantity, by one of those numbers, and that product by the next, and so on, until you have multiplied by all the numbers, and the last product is the answer; but, if the quantity required, is such a number, as cannot be produced by the product of two or more numbers, take such numbers, as whose product will come nearest the quantity; then find the value of the remainder by the last Case.

EXAMPLES.

1. What will 42 yards of cloth cost at 6s. 9d. a yard?

| | £ | s. | d. | |
|--|----|----|----|--------------------|
| In this example, | 0 | 6 | 9 | |
| we find that 6 multiplied by 7 will | | | 6 | |
| produce the quantity 42 yards; we | 2 | 0 | 6 | price of 6 yards. |
| therefore multiply | | | 7 | |
| 6s. 9d. first by the | 14 | 3 | 6 | price of 42 yards. |
| 6, and then its product by 7; and the last product £14 3s. 6d. | | | | |
| is the answer, or price of the 42 yards. | | | | |

2. What is the value of 53 tons of iron, at £18 17s. 11d. a ton?

| £ | s. | d. | | £ | s. | d. | |
|-------|----|----|------------------|-------|----|----|-------------------|
| 18 | 17 | 11 | | 18 | 17 | 11 | |
| | | 3 | | | | 5 | |
| <hr/> | | | | <hr/> | | | |
| 56 | 13 | 9 | price of 3 tons. | 94 | 9 | 7 | price of 5 tons. |
| | | | | | | 10 | |
| <hr/> | | | | <hr/> | | | |
| | | | | 944 | 15 | 10 | price of 50 tons. |
| | | | | 56 | 13 | 9 | price of 3 tons. |
| <hr/> | | | | <hr/> | | | |
| | | | | 1001 | 9 | 7 | price of 53 tons. |

Because 53 is a *prime* number, it cannot be produced by the multiplying of any two numbers; we therefore find a convenient number less than the given one, viz. 50, which may be produced by multiplying 5 by 10; and having found the price of 50 tons as in the last example, we then find the price of the 3 remaining tons by the last Case, and add it to the former, making the value of the whole quantity, £1001 9s. 7d.

3. What will 16 yds. of velvet cost, at 3s. 8d. per yd.?

Ans. £2 18s. 8d.

4. What will 72 yds. of broadcloth cost, at 19s. 11d. per yd.?

Ans. £71 14s. 0d.

5. What will 84 yds. of cotton cost, at 1s. 11d. per yd.?

Ans. £8 1s. 0d.

6. What will 57 gallons of wine cost at 8s. 3½d. per gallon?

Ans. £23 11s. 5½d.

7. Bought 9 hogsheads of sugar, each weighing 12cwt. 2qr. 11lb.; what was the weight of the whole?

Ans. 56T. 13cwt. 3qr. 10lb.

8. Bought 29 lots of wild land, each containing 117A. 3R. 27p; what was the contents of the whole?

Ans. 3419A. 2R. 23p.

9. Bought 89 pieces of cloth, each containing 37yds. 3qr. 2na. 2in; what was the whole quantity?

Ans. 3375yds. 3qr. 1na. 0½in.

10. Bought 59 casks of wine, each containing 47gal. 3qt. 1pt.; what was the whole quantity?

Ans. 44hhd. 52gal. 2qt. 1pt.

11. If a man travel 17m. 3fur. 13rd. 14ft. in one day, how far will he travel in a year?

Ans. 6356m. 5fur. 14rd. 11½ft.

12. If a man drink 3gal. 1qt. 1pt. of beer in a week, how much will he drink in 52 weeks?

Ans. 171gal. 2qt.

13. There are 17 sticks of timber, each containing 37ft. 978in. ; what is the whole quantity ?

Ans. 15T. 35ft. 1074in.

14. There are 17 piles of wood, each containing 7 cord, 98 cubic feet ; what is the whole quantity ?

Ans. 119 cords, 1666ft.

15. If a man be 2da. 5h. 17m. 19sec. in walking one degree, how long would it take him to walk round the globe, allowing $365\frac{1}{4}$ days to a year ?

Ans. 2y. 68da. 19h. 54m.

BILLS.

16.

London, July 4, 1835.

Dow, Vance & Co., of Boston, U. S.,

Bought of Samuel Snow

| | | |
|---------------------|----|--------------------------|
| 45 yds. Broadcloth, | at | 8s. 4d. |
| 50 " " | " | 10s. 6d. |
| 56 " " | " | 3s. 7 $\frac{1}{2}$ d. |
| 63 " " | " | 12s. 11 $\frac{1}{2}$ d. |
| 72 " " | " | 19s. 11d. |
| 81 " " | " | 9s. 3d. |
| 35 " " | " | 19s. 7 $\frac{1}{2}$ d. |
| 99 " " | " | 16s. 0 $\frac{1}{2}$ d. |
| 66 " " | " | 8s. 11d. |
| 33 " " | " | 16s. 11 $\frac{1}{2}$ d. |

£387 5s. 10d.

Received payment,

Samuel Snow.

17.

Liverpool, June 2, 1835.

John Jones, of Philadelphia, U. S.,

Bought of Thomas Hogarth

| | | | |
|----------|-------------------|----|-----------|
| 297 yds. | Black Broadcloth, | at | 17s. 3½d. |
| 473 " | Blue " | " | 9s. 11½d. |
| 512 " | Red " | " | 15s. 10d. |
| 624 " | Green " | " | 12s. 8d. |
| 765 " | White " | " | 19s. 9½d. |
| 169 " | Black Velvet, | " | 13s. 5½d. |
| 698 " | Green " | " | 15s. 6½d. |
| 315 " | Red " | " | 14s. 3½d. |
| 713 " | White " | " | 11s. 7½d. |
| 519 " | Carpet, | " | 13s. 6½d. |
| 147 " | Black Kersimere, | " | 16s. 7½d. |
| 386 " | Blue " | " | 14s. 3½d. |
| 137 " | Green " | " | 19s. 9d. |
| 999 " | Black Silk, | " | 15s. 8d. |

£5012 Os. 11½d.

Received payment,

Thomas Hogarth.

COMPOUND DIVISION.

Compound Division is when the dividend consists of several denominations.

RULE.

Divide the highest denomination by the quantity, and if any thing remains, reduce it to the next lower denomination, and continue to divide, until it is reduced to the lowest denomination.

NOTE.—When the operation is performed by short division, let the several quotients be placed under their respective denominations.

EXAMPLES.

1. Divide £598 8s. 6½d. equally between 5 persons.

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 5) \begin{array}{r} 598 \\ 8 \\ 6\frac{1}{2} \end{array} \\
 \hline
 \begin{array}{r} 119 \\ 13 \\ 8\frac{1}{2} \end{array}
 \end{array}$$

Having divided the pounds by 5, we find the remainder to be £3, which we reduce to shillings, and find the number to be 60; to these we add the 8s. in the question, and find their number to be 68; we then find how many times 5 is contained in 68, which is 13 times and 3 shillings remaining; we place the 13 under the 8, and reduce the 3 shillings to pence, which make 36; to this we add the 6d. in the question, which make 42 pence; we then divide the 42 pence by 5, and find the quotient to be 8, which we place under the 6d., and that 2d. remain, which we reduce to farthings, and find them to be 8; to them we add the two farthings, in the question, and find their number to be 10; then we divide by 5, and find the quotient to be 2 farthings, which we place under the 2 farthings in the question, and the work is done.

2. Divide £168 15s. 0d. equally between 36 men.

Ans. £4 13s. 9d.

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 36) \begin{array}{r} 168 \\ 15 \\ 0 \end{array} \quad (\text{£4} \\
 \hline
 \begin{array}{r} 144 \\ 24 \\ 2 \end{array} \\
 \hline
 36) \begin{array}{r} 495 \\ 36 \end{array} \quad (13\text{s.} \\
 \hline
 \begin{array}{r} 135 \\ 108 \\ 27 \\ 12 \end{array} \\
 \hline
 36) \begin{array}{r} 324 \\ 324 \end{array} \quad (9\text{d.}
 \end{array}$$

3. Divide £151 19s. 11½d. by 9.
 4. Divide £350 17s. 3½d. by 519.
 5. Divide £225 1s. 10½d. by 63.

Ans. £16 17s. 9½d.
 Ans. 13s. 6½d.
 Ans. £3 11s. 5½d.

6. Divide £159 4s. 9d. by 12. Ans. £13 5s. 4½d.
7. Divide 158lb. 9oz. 1dwt. 21gr. by 9.
 Ans. 17½lb. 7oz. 13dwt. 13gr.
8. Divide 111lb. 11oz. 17dwt. 9gr. by 7.
 Ans. 15½lb. 11oz. 19dwt. 15gr.
9. Divide 183T. 1cwt. 2qr. 11lb. 4oz. by 11.
 Ans. 16T. 12cwt. 3qr. 13lb. 12oz.
10. Divide 63T. 14cwt. 3qr. 18lb. 12oz. 10dr. by 8.
 Ans. 7T. 19 cwt. 1qr. 12lb. 13oz. 9¼dr.
11. Divide 19½b. 9¾. 43. 2½. 9gr. by 8.
 Ans. 2½b. 5¾. 53. 1½. 16½gr.
12. Divide 335yd. 2qr. 0na. 0½in. by 7.
 Ans. 47yd. 3qr. 2na. 2in.
13. Divide 215m. 7fur. 1rd. 14ft. 6in. by 12.
 Ans. 17m. 7fur. 36rd. 13ft. 7in.
14. Divide 97 deg. 55m. 7fur. 35rd. 4ft. 2in. 1br. by 6.
 Ans. 16deg. 20m. 7fur. 12rd. 8ft. 11in. 1⅙ br.
15. Divide 318A. 3R. 24p. 5yd. 6ft. 80in. by 32.
 Ans. 9A. 3R. 34p. 15yd. 2ft. 106in.
16. Divide 181A. 3R. 11p. 6yd. 4ft. 41in. by 11.
 Ans. 16A. 2R. 4p. 19yd. 7ft. 79in.
17. Divide 31 cords, 83ft. 1332in. by 4.
 Ans. 7 cord, 116ft. 1629in.
18. Divide 89hhd. 54gal. by 39.
 Ans. 2hhd. 19gal. 0qt. 1⅓pt.
19. Divide 179bu. 3pk. 1qt. by 53.
 Ans. 3bu. 1pk. 4qt. 1pt. 0⅔gi.
20. Divide 275chald. 17bu. by 17.
 Ans. 16ch. 7bu. 1pk. 3qt. 0⅓pt.
21. Divide 110y. 343da. 3h. 41m. 12sec. by 8.
 Ans. 13y. 316da. 15h. 27m. 39sec.

CASE II.

When the quantity is a composite number, and the price of unity is required, divide by two such numbers whose product is equal to the quantity, and the last quotient is the answer.

1. If 16yds. of cotton cost £2 18s. 8d. what is the price of one yard?

| | | |
|------|----|-----|
| £ | s. | d. |
| 4) 2 | 18 | 8 |
| | | |
| 4) 0 | 14 | 8 |
| | | |
| Ans. | 0 | 3 8 |

We divide by 4 twice, because 4 times 4 are 16, the quantity given.

2. If 18 sheep cost £5 4s. 3d. what is the value of one sheep?

Ans. 5s. 9½d.

3. If 21 yds. of cloth in London, cost £10 18s. 3d. what is the price of one yard?

Ans. 9s. 11d.

4. If 22 hats be valued at £12 13s. what is the value of one hat?

Ans. 11s. 6d.

5. A bill of exchange on London for £1290 4s. is to be equally divided between 96 persons; what is each man's share?

Ans. £13 8s. 9½d.

6. A goldsmith has 32lb. 9oz. 15dwt. of silver, of which he makes 120 spoons. What must be the weight of each?

Ans. 3oz. 7dwt. 15gr.

7. A man divides his farm of 214A. 3R. 12p. equally between his nine sons. How much does each one receive?

Ans. 23A. 3R. 12p.

8. If a man in one month travel 746m. 4fur. 40rd. how far does he go in one day?

Ans. 24m. 7fur. 4rd.

9. If the earth revolve 15° on its axis in one hour, how far does it revolve in one minute?

Ans. 0° 15'.

10. A farmer has 29 bushels of rye, which he wishes to put into 3 bags, how much must each bag contain?

Ans. 3bu. 2pk. 4qt.

11. If a man can perform a certain piece of labor in 3da. 16h. 54m., how long would it take 12 men to perform the same work?

Ans. 7h. 24m. 30sec.

CASE III.

When the value of a fractional part is required,

RULE. — Multiply the price by the numerator, and divide by the denominator; but if the price of a fractional part be given, and it is required to find the value or integer, multiply the price by the denominator and divide by the numerator.

EXAMPLES.

1. If the whole of a ship and cargo be valued at £2346
 12s. 8d. what is $\frac{3}{4}$ worth? Ans. £1759 19s. 6d.

| | | |
|---------|----|----|
| £ | s. | d. |
| 2346 | 12 | 8 |
| | | 3 |
| <hr/> | | |
| 4) 7039 | 18 | 0 |
| <hr/> | | |
| 1759 | 19 | 6 |

2. Bought $\frac{5}{8}$ of a lottery ticket, which drew a prize of \$1500; what was my share of the prize money? Ans. \$240.
3. If $\frac{7}{12}$ of an estate be valued at \$1728,50, what is the value of the whole? Ans. \$2961,42 $\frac{1}{2}$.
4. A vessel and cargo is valued at \$10,000, and $\frac{1}{4}$ of the cargo was sold for \$5780, what was the value of the vessel? Ans. \$2775,00.

BILLS.

Boston, July 4, 1835.

Mr. James Dow

Bought of Dennis Sharp

| | | | | |
|---------|-----------------|----|-----|------|
| 17 yds. | Flannel, | at | ,45 | cts. |
| 19 " | Shalloon, | " | ,37 | " |
| 16 " | Blue Camlet, | " | ,46 | " |
| 13 " | Silk Vesting, | " | ,87 | " |
| 9 " | Cambric Muslin, | " | ,63 | " |
| 25 " | Bombazin, | " | ,56 | " |
| 17 " | Ticking, | " | ,31 | " |
| 19 " | Striped Jean, | " | ,16 | " |

\$61,33

Received payment,

Dennis Sharp.

Haverhill, May 5, 1835.

Mr. Samuel Smith

Bought of David Johnson

| | | | | |
|----|--------------|----|----|------|
| 13 | lbs. Tea, | at | 98 | cts. |
| 16 | " Coffee, | " | 15 | " |
| 36 | " Sugar, | " | 13 | " |
| 47 | " Cheese, | " | 09 | " |
| 12 | " Pepper, | " | 19 | " |
| 07 | " Ginger, | " | 17 | " |
| 13 | " Chocolate, | " | 61 | " |

 \$35,45.

Received payment,

David Johnson.

Salem, February 29, 1835.

Mr. John Dow

Bought of Richard Fuller

| | | | |
|----|----------------------|----|--------|
| 17 | yds. Broadcloth, | at | \$5,25 |
| 29 | " Cassimere, | " | 1,62 |
| 60 | " Bleach'd Shirting, | " | 17 |
| 49 | " Ticking, | " | 27 |
| 18 | " Blue cloth, | " | 3,19 |
| 27 | " Habit cloth, | " | 2,75 |
| 75 | " Flannel, | " | 61 |
| 36 | " Plaid prints, | " | 75 |
| 49 | " Brown Sheeting, | " | 18 |

 \$372,10.

Received payment,

Richard Fuller.

Andover, July 18, 1835.

Mr. James Trow

Bought of James Flint

| | | | | |
|----|---------|-----------|----|----------|
| 17 | gallons | Molasses, | at | \$0,35 |
| 29 | " | Oil, | " | ,78 |
| 47 | " | Wine, | " | ,98 |
| 26 | bushels | Corn, | " | ,78 |
| 71 | " | Rye, | " | 1,12 |
| 46 | " | Wheat, | " | 1,63 |
| 14 | " | Salt, | " | ,95 |
| 37 | " | Potatoes, | " | ,27 |
| | | | | <hr/> |
| | | | | \$272,70 |

Received payment,

John Jones, for

James Flint.

New York, June 3, 1835.

Mr. John Atwood

Bought of Sam'l Webster

| | | | | |
|----|---------|---------------|----|-----------|
| 23 | hhd. | Molasses, | at | \$23,56 |
| 65 | bushels | Salt, | " | 1,65 |
| 71 | gallons | Sperm Oil, | " | 1,16 |
| 28 | dozen | Men's Gloves, | " | 7,50 |
| 16 | cwt. | Iron, | " | 6,75 |
| 33 | " | Hemp, | " | 45,50 |
| 17 | " | Sugar, | " | 11,25 |
| 96 | lbs. | Hyson Tea, | " | 1,17 |
| 19 | " | Souchong Tea, | " | ,47 |
| 57 | yds. | Dimity, | " | ,38 |
| | | | | <hr/> |
| | | | | \$288,15. |

Received payment,

Sam'l Webster, by

Moses Greenleaf

Methuen, May 25, 1835.

Mr. Samuel Emerson

Bought of John Dix

| | | | |
|---------|---------|----|--------|
| 17 lbs. | Flax, | at | \$0,17 |
| 98 " | Cheese, | " | ,09 |
| 48 " | Butter, | " | ,19 |
| 68 " | Sugar, | " | ,13 |
| 14 " | Starch, | " | ,21 |
| 27 " | Cocoa, | " | ,17 |
| 83 " | Flour, | " | ,05 |

 \$41,35.

Received payment,

John Dix.

Albany, July 20, 1835.

Mr. Job Sampson

Bought of Kimball & Jones

| | | | |
|------------|--------------|----|--------|
| 16 bushels | Rye, | at | \$1,10 |
| 19 " | Wheat, | " | 1,37 |
| 47 lbs. | Butter, | " | ,17 |
| 69 " | Wool, | " | ,58 |
| 48 " | Hops, | " | ,05 |
| 98 " | Clover Seed, | " | ,11 |
| 48 " | Black Tea, | " | ,35 |

 \$121,62.

Received payment,

Kimball & Jones.

Baltimore, Jan. 20, 1835.

Mr. John Rilley

Bought of James Somes

| | | |
|-----------------|----|--------|
| 10 pair Boots, | at | \$2,75 |
| 19 " Shoes, | " | 1,25 |
| 83 " Hose, | " | 1,20 |
| 47 lbs. Ginger, | " | ,17 |
| 91 " Chocolate, | " | ,39 |
| 47 " Pepper, | " | ,23 |
| 68 " Flour, | " | ,13 |
| 27 pair Gloves, | " | 1,39 |

 \$258,98.

Received payment,

James Somes.

Philadelphia, June 11, 1835.

Mr. Moses Thomas

Bought of Luke Dow

| | | |
|-----------------------------|----|--------|
| 27 National Spelling Books, | at | \$0,19 |
| 25 Young Readers, | " | ,27 |
| 17 Liber Primus, | " | ,75 |
| 9 Greek Lexicon, | " | 3,75 |
| 8 Ainsworth's Dictionary, | " | 4,50 |
| 27 Greek Readers, | " | 2,25 |
| 18 Folio Bibles, | " | 9,87 |
| 75 Testaments, | " | ,31 |
| 67 National Readers, | " | ,75 |
| 15 Pocket Bibles, | | 1,12 |

 \$423,09.

Received payment,

Luke Dow, by

Timothy True.

Boston, June 26, 1835.

Dr. Enoch Cross

Bought of Maynard & Noyes

| | | | |
|--------|----------------|----|--------|
| 14 oz. | Ipecacuanha, | at | \$0,67 |
| 23 " | Laudanum, | " | ,89 |
| 17 " | Emetic Tartar, | " | 1,25 |
| 25 " | Cantharides, | " | 2,17 |
| 27 " | Gum Mastic, | " | ,61 |
| 56 " | Gum Camphor, | " | ,27 |

 \$136,94.

Received payment,

 Maynard & Noyes,
 by Timothy Jones.

Newburyport, June 5, 1835.

Mr. John Somes

Bought of Samuel Gridley

| | | | |
|----------|-------------|----|--------|
| 7½ yds. | Broadcloth, | at | \$4,50 |
| 16½ lbs. | Coffee, | " | ,16 |
| 18½ " | Candles, | " | ,25 |
| 30 " | Soap, | " | ,17 |
| 3 " | Pepper, | " | ,19 |
| 7½ " | Ginger, | " | ,18 |

 \$48,01.

Received payment,

Samuel Gridley.

New York, July 11, 1835.

Mr. John Cummings

Bought of Lord & Secomb

| | | | |
|-----|----------------------|----|--------|
| 97 | bls. Genessee Flour, | at | \$6,25 |
| 167 | " Philadelphia " | " | 5,95 |
| 87 | " Baltimore " | " | 6,07 |
| 196 | " Richmond " | " | 5,75 |
| 275 | " Howard st. " | " | 7,25 |
| 69 | bu. Rye, | " | 1,16 |
| 136 | " Virginia Corn, | " | ,67 |
| 68 | " North river " | " | ,76 |
| 169 | " Wheat, | " | 1,37 |
| 76 | Ton Lehi Coal, | " | 9,67 |
| 89 | " Iron, | " | 69,70 |
| 49 | Grindstones, | " | 3,47 |
| 39 | Pitchforks, | " | 1,61 |
| 197 | Rakes, | " | ,17 |
| 86 | Hoes, | " | ,69 |
| 78 | Shovels, | " | 1,17 |
| 187 | Spades, | " | ,85 |
| 91 | Ploughs, | " | 11,61 |
| 83 | Harrows, | " | 17,15 |
| 47 | Handsaws, | " | 3,16 |
| 35 | Mill Saws, | " | 18,15 |
| 47 | cwt. Steel, | " | 9,47 |
| 57 | " Lead, | " | 6,83 |

 \$17,315,32.

Received payment,

Lord & Secomb.

Boston, May 1, 1835.

Mr. Benjamin Treat

Bought of John True

| | | | |
|----|------------------------|----|---------|
| 37 | Chests Green Tea, | at | \$25,50 |
| 41 | " Black " | " | 16,17 |
| 40 | Casks Wine, | " | 97,75 |
| 13 | Crates Liverpool Ware, | " | 169,37 |

 \$7,718,28.

Received payment,

John True,

London, May 11, 1835.

Messrs. Kimball & Fox, of Boston, U. S.

Bought of Benjamin Fowler

| | | | |
|----------|-------------------|----|-------------|
| 297 yds. | Black Broadcloth, | at | £ 17s. 3½d. |
| 473 " | Blue " | " | 9s. 11½d. |
| 512 " | Green " | " | 15s. 10d. |
| 624 " | Black Silk, | " | 12s. 8d. |
| 765 " | Pongee " | " | 19s. 9½d. |
| 169 " | Black Cassimere, | " | 13s. 5½d. |
| 698 " | Blue " | " | 15s. 6½d. |
| 315 " | Durant, | " | 14s. 3½d. |
| 713 " | Silk Vesting, | " | 11s. 7½d. |
| 519 doz. | Silk Hose, | " | 13s. 6½d. |
| 147 ps. | Nankin, | " | 16s. 7½d. |
| 386 yds. | Irish linen, | " | 14s. 3½d. |

£4094 4s. 2½d.

Received payment,

Benjamin Fowler.

Montreal, July 4, 1835.

Mr. James Savage

Bought of Joseph Dowe

| | | | |
|-----------|----------------------|----|------------|
| 83 galls. | Lisbon Wine, | at | 6s. 7d. |
| 85 " | Port " | " | 3s. 9½d. |
| 86 " | Madeira " | " | 4s. 11½d. |
| 87 " | Temperance " | " | 3s. 6½d. |
| 89 " | Oil, | " | 5s. 3d. |
| 91 | Leghorns, | " | 19s. 10½d. |
| 92 lbs. | Green Tea, | " | 3s. 1½d. |
| 93 pair | Thread Hose, | " | 4s. 4½d. |
| 94 " | Silk Gloves, | " | 3s. 3½d. |
| 95 " | Silk Hose, | " | 6s. 6½d. |
| 97 yds. | Linen, | " | 5s. 5½d. |
| 98 galls. | Winter Strained Oil, | " | 7s. 7½d. |

£338 19s. 2½d.

Received payment,

Joseph Dowe.

Montreal, June 17, 1835.

Mr. Samuel Simpson

Bought of Lackington, Grey & Co.

| | | |
|------------------|----|-----------|
| 19 yds. Cloth, | at | £ 1s. 6d. |
| 23 " Worsted, | " | 7s. 8½d. |
| 26 " Baize, | " | 3s. 11½d. |
| 29 " Camlet, | " | 6s. 10½d. |
| 31 " Bombazin, | " | 1s. 5½d. |
| 34 " Linen, | " | 3s. 7d. |
| 37 " Cotton, | " | 11s. 9d. |
| 38 " Flannel, | " | 6s. 11d. |
| 39 " Calico, | " | 3s. 10½d. |
| 41 " Broadcloth, | " | 6s. 9½d. |
| 43 " Nankin, | " | 7s. 5½d. |

 £106 1s. 11½d.

Received payment,

Lackington, Grey & Co.

Quebec, Jan. 8, 1835.

Mr. John Vose

Bought of Vans & Conant

| | | |
|------------------------|----|------------|
| 46 Ivory Combs, | at | £ 3s. 5½d. |
| 47 lb. Colored Thread, | " | 6s. 9½d. |
| 51 yds. Durant, | " | 1s. 8d. |
| 52 Silk Vests, | " | 6s. 7d. |
| 53 Leghorns, | " | 11s. 9½d. |
| 57 ps. Nankin, | " | 8s. 3½d. |
| 58 lbs. White Thread, | " | 9s. 11½d. |

 £128 16s. 5½d.

Received payment,

Vans & Conant.

Liverpool, January 20, 1835.

Mr. John Dix

Bought of Thomas Gray

| | | | |
|-------------------------|----|---|------------|
| 73 yds. Broadcloth, | at | £ | 19s. 11d. |
| 74 " Blue Cloth, | " | | 9s. 9½d. |
| 75 " Canton Crape, | " | | 3s. 8d. |
| 76 " Twilled Coating, | " | | 3s. 11d. |
| 78 " Colored Lutstring, | " | | 10s. 10½d. |
| 79 " Durant, | " | | 3s. 5½d. |
| 82 " Flannel, | " | | 4s. 11d. |
| 83 " Silk Vesting, | " | | 6s. 7d. |

£240 19s. 0½d.

Received payment,

Thomas Gray.

MENTAL OPERATIONS IN FRACTIONS.

NOTE.—The pupil is requested before he commences the mental operations of Fractions, to carefully examine the definitions on page 94.

1. If $\frac{1}{2}$ of a barrel of cider cost 2 dollars, what will a barrel cost?

2. Bought $\frac{1}{3}$ of a barrel of flour for 2 dollars, what would be the price of a barrel?

3. If $\frac{1}{4}$ of a yard of cloth cost 3 dollars, what will $\frac{3}{4}$ cost? What will $\frac{1}{2}$ cost? What will a yard cost?

4. If $\frac{1}{5}$ of a barrel of flour cost 2 dollars, what will $\frac{2}{5}$ cost? $\frac{3}{5}$? $\frac{4}{5}$? $\frac{1}{5}$? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{4}{5}$? $\frac{1}{5}$?

5. If $\frac{1}{6}$ of a pound of pepper cost 3 cents, what will $\frac{2}{6}$? $\frac{3}{6}$? $\frac{4}{6}$? $\frac{5}{6}$? $\frac{1}{6}$? $\frac{2}{6}$? $\frac{3}{6}$?

6. Bought $\frac{1}{7}$ of a barrel of sugar for 2 dollars, what was the price of $\frac{2}{7}$? $\frac{3}{7}$? $\frac{4}{7}$? $\frac{5}{7}$? $\frac{1}{7}$?

7. If a man bought $\frac{1}{8}$ of a firkin of butter for 7 cents, what did the whole firkin cost?

8. Bought $\frac{1}{12}$ of an acre of land for 5 dollars, what was the price of an acre? Of 2 acres? Of 10 acres? Of 20 acres?

9. Bought $\frac{1}{4}$ of a pound of ginger for 4 cents, what did a pound cost?

10. Bought $\frac{1}{10}$ of a chest of tea for 5 dollars, what did $\frac{1}{10}$ cost? $\frac{3}{10}$? $\frac{4}{10}$? $\frac{5}{10}$? $\frac{10}{10}$?

11. Bought $\frac{1}{11}$ of a load of hay for 3 dollars, what did the load cost? What did 2 loads cost?

12. If $\frac{1}{4}$ of a cask of wine cost 9 dollars, what was that a cask?

13. 2 is $\frac{1}{3}$ of what number?

14. 4 is $\frac{1}{4}$ of what number?

15. 6 is $\frac{1}{5}$ of what number?

16. 7 is $\frac{1}{6}$ of what number?

17. 9 is $\frac{1}{7}$ of what number?

18. 8 is $\frac{1}{8}$ of what number?

19. 10 is $\frac{1}{10}$ of what number?

20. 12 is $\frac{1}{12}$ of what number?

21. 11 is $\frac{1}{11}$ of what number?

22. 14 is $\frac{1}{14}$ of what number?

23. 15 is $\frac{1}{15}$ of what number?

24. 7 is $\frac{1}{17}$ of what number?

25. 8 is $\frac{1}{18}$ of what number?

26. If $\frac{2}{5}$ of a pound of sugar cost 4 cents, what will $\frac{1}{5}$ of a pound cost? What will a pound cost? 4 is $\frac{2}{5}$ of what number?

27. If $\frac{3}{4}$ of a pound of nutmeg cost 6 cents, what will $\frac{1}{4}$ of a pound cost? If $\frac{1}{4}$ of a pound cost 2 cents, what will a pound cost? 6 is $\frac{3}{4}$ of what number?

28. If $\frac{5}{8}$ of a cwt. of starch cost 10 dollars, what will $\frac{1}{8}$ of a cwt. cost? What will a cwt. cost? 10 is $\frac{5}{8}$ of what number?

29. If $\frac{2}{3}$ of a barrel of molasses cost 4 dollars, what is the value of $\frac{1}{3}$ of a barrel? If $\frac{1}{3}$ of a barrel cost 2 dollars, what will a barrel cost? 4 is $\frac{2}{3}$ of what number?

30. If $\frac{3}{5}$ of a pound of candles cost 15 cents, what will $\frac{1}{5}$ of a pound cost? If $\frac{1}{5}$ of a pound cost 3 cents, what will a pound cost? 15 is $\frac{3}{5}$ of what number?

31. Bought $\frac{4}{5}$ of a pound of mace for 20 cents, what was the cost of $\frac{1}{5}$ of a pound? If $\frac{1}{5}$ of a pound cost 4 cents, what will a pound cost? 20 is $\frac{4}{5}$ of what number?

32. If $\frac{1}{12}$ of a pound of opium cost 55 cents, what will $\frac{1}{12}$ of a pound cost? If $\frac{1}{12}$ of a pound cost 5 cents, what will a pound cost? 55 is $\frac{1}{12}$ of what number?

33. 6 is three times what number?

34. 15 is three times what number?

35. 20 is four times what number?

36. 21 is seven times what number?

37. 24 is four times what number?

38. 25 is five times what number?

39. 3 is three times what number?

40. 18 is nine times what number?

41. If 6 be $\frac{2}{3}$ of some number, what will be $\frac{1}{3}$ of the same number? If 3 be $\frac{1}{3}$ of a number, what is that number?

42. 3 is $\frac{1}{3}$ of what number?

43. If $\frac{6}{7}$ of a pound of sugar cost 12 cents, what will $\frac{1}{7}$ of a pound cost? If $\frac{1}{7}$ of a pound cost 2 cents, what will a pound cost?

44. If $\frac{4}{11}$ of a pound of nutmegs cost 20 cents, what will $\frac{1}{11}$ cost? If $\frac{1}{11}$ cost 5 cents, what will a pound cost? 20 is $\frac{4}{11}$ of what number?

45. If $\frac{8}{9}$ of a quarter of veal cost 64 cents, what will $\frac{1}{9}$ of a pound cost? If $\frac{1}{9}$ of a pound cost 8 cents, what will a pound cost? 64 is $\frac{8}{9}$ of what number?

46. Bought $\frac{7}{8}$ of a ton of potash for 84 dollars, what did $\frac{1}{8}$ of a ton cost? If $\frac{1}{8}$ of a ton cost 12 dollars, what did a ton cost? 84 is $\frac{7}{8}$ of what number?

47. Bought $\frac{7}{8}$ of a barrel of pork for 14 dollars, what was the cost of $\frac{1}{8}$ of a barrel? If $\frac{1}{8}$ of a barrel cost 2 dollars, what was the price of a barrel? 14 is $\frac{7}{8}$ of what number?

48. Bought $\frac{3}{4}$ of a barrel of fish for 18 dollars, what did $\frac{1}{4}$ of a barrel cost? If $\frac{1}{4}$ of a barrel cost 9 dollars, what was the value of a barrel? 18 is $\frac{3}{4}$ of what number?

49. If $\frac{7}{12}$ of an acre of land cost 42 dollars, what is the value of $\frac{1}{12}$ of an acre? If $\frac{1}{12}$ of an acre cost 6 dollars, what is the value of an acre? 42 is $\frac{7}{12}$ of what number?

50. If $\frac{7}{10}$ of a bushel of apples cost 35 cents, what will $\frac{1}{10}$ of a bushel cost? If $\frac{1}{10}$ of a bushel cost 5 cents, what is the value of a bushel? 35 is $\frac{7}{10}$ of what number?

51. If $\frac{7}{8}$ of a bushel of corn cost 63 cents, what is $\frac{1}{8}$ of a bushel worth? If $\frac{1}{8}$ of a bushel cost 9 cents, what is the value of a bushel? 63 is $\frac{7}{8}$ of what number?

52. If $\frac{1}{11}$ of a pound of saleratus cost 8 cents, what is $\frac{1}{11}$ of a pound worth? If $\frac{1}{11}$ of a pound cost 2 cents, what does a pound cost?

53. If $\frac{1}{11}$ of a load of hay is sold for 14 dollars, what is $\frac{1}{11}$ of a load worth? If $\frac{1}{11}$ of a load cost 2 dollars, what will 5 loads cost? 14 is $\frac{1}{11}$ of what number?

54. If 10 cents will buy $\frac{1}{11}$ of a pound of figs, how many cents will buy a pound?

55. If 12 dollars will buy $\frac{1}{11}$ of a cwt. of sugar, how many dollars will it take to buy a cwt.?

56. 8 is $\frac{1}{11}$ of what number?

57. 9 is $\frac{1}{11}$ of what number?

58. 12 is $\frac{1}{11}$ of what number?

59. 4 is $\frac{1}{11}$ of what number?

60. 3 is $\frac{1}{11}$ of what number?

61. 15 is $\frac{1}{11}$ of what number?

62. 18 is $\frac{1}{11}$ of what number?

63. 20 is $\frac{1}{11}$ of what number?

64. 21 is $\frac{1}{11}$ of what number?

65. 25 is $\frac{1}{11}$ of what number?

66. 24 is $\frac{1}{11}$ of what number?

67. 27 is $\frac{1}{11}$ of what number?

68. 30 is $\frac{1}{11}$ of what number?

69. If $\frac{1}{11}$ of a bushel of salt cost 42 cents, how many pounds of raisins at 6 cents a pound, would it take to purchase a bushel?

70. If $\frac{1}{11}$ of a load of hay cost 18 dollars, how many barrels of cider at three dollars a barrel would it take to purchase a load? 18 is $\frac{1}{11}$ of how many times 3?

71. Bought $\frac{1}{11}$ of a yard of cloth for 60 cents; how many pounds of sugar at 9 cents would pay for one yard? 60 is $\frac{1}{11}$ of how many times nine?

72. A man sold a pair of oxen for 48 dollars, which was $\frac{1}{11}$ of what they cost him; he had paid for them in calves at 6 dollars a head. How many calves did it take to pay for the oxen?

73. 28 is $\frac{1}{11}$ of how many times 7?

74. 12 is $\frac{1}{11}$ of how many times 6?

75. 32 is $\frac{1}{11}$ of how many times 10?

76. 60 is $\frac{1}{11}$ of how many times 14?

77. 72 is $\frac{8}{9}$ of how many times 9 ?
 78. 64 is $\frac{7}{8}$ of how many times 4 ?
 79. 50 is $\frac{10}{13}$ of how many times 5 ?
 80. 36 is $\frac{9}{7}$ of how many times 14 ?

VULGAR FRACTIONS.

Vulgar Fractions are any assignable parts of a unit.

They are expressed by two numbers, called the numerator and denominator; the former above and the latter below a line.

Thus: Numerator 7
 Denominator $\overline{11}$

The denominator shows into how many parts the integer or whole number is divided.

The numerator shows how many of these parts are taken.

1. A simple fraction is one whose denominator exceeds the numerator, as $\frac{7}{8}$.

2. An improper fraction is when the numerator exceeds, or is equal to the denominator; as $\frac{17}{12}$ or $\frac{8}{8}$.

3. A mixed number is a whole number and a fraction; as $7\frac{6}{11}$ $5\frac{3}{8}$.

4. A compound fraction is a fraction of a fraction, connected by the word of; as $\frac{7}{8}$ of $\frac{5}{8}$ of $\frac{8}{9}$ of $\frac{3}{4}$.

5. A compound mixed fraction is one that has either its numerator or denominator a fraction; as $7\frac{1}{2}$ $\frac{4\frac{3}{4}}{11}$ or $\frac{7\frac{1}{2}}{7\frac{1}{5}}$.

6. The common measure of two or more numbers is the largest number that will divide them without a remainder.

7. The least common multiple of two or more numbers is the least number that may be divided by them without a remainder.

8. A fraction is in its lowest terms, when no number but a unit will measure both its terms.

9. A prime number is that, which can be measured only by itself or a unit.

10. A perfect number is equal to the sum of all its aliquot parts; as 6, 28, 496, &c.

11. A fraction is equal to the number of times, that the numerator contains the denominator.

12. The value of a fraction depends on the proportion, which the numerator bears to the denominator.

CASE I.

To find the greatest common measure of two or more numbers, or to find the greatest number, that will divide two or more numbers,

RULE.—Divide the greater number by the less, and if there be a remainder, divide the last divisor by it, and so continue dividing the last divisor by the last remainder, until nothing remains, and the last divisor is the greatest common measure.

If there be more than two numbers, find the greatest common measure, and so proceed through all the numbers to the last. If it should happen that 1 is the common measure, the numbers are prime to each other, and are incommensurable.

EXAMPLES.

1. What is the greatest common measure of 98 and 114?

$$\begin{array}{r} 98 \overline{) 114} \quad (1 \\ \underline{98} \end{array}$$

$$\begin{array}{r} 16 \overline{) 98} \quad (6 \\ \underline{96} \end{array}$$

$$\begin{array}{r} \text{Common measure } 2 \overline{) 16} \quad (8 \\ \underline{16} \end{array}$$

By this process, it is found that 2 is the greatest number, that will divide 98 and 114.

2. What is the greatest common measure of 56 and 168?

Ans. 56.

3. What is the greatest common measure of 96 and 128?

Ans. 32.

4. What is the greatest common measure of 57 and 285?

Ans. 57.

5. What is the greatest common measure of 169 and 175 ?
Ans. 1.
6. What is the greatest common measure of 175 and 455 ?
Ans. 35.
7. What is the greatest common measure of 169 and 866 ?
Ans. 4.
8. What is the greatest common measure of 47 and 478 ?
Ans. 1.
9. What is the greatest common measure of 84 and 1068 ?
Ans. 12.
10. What is the greatest common measure of 75 and 165 ?
Ans. 15.
11. What is the greatest common measure of 78, 234 and 468 ?
Ans. 78.
12. What is the greatest common measure of 144, 485 and 25 ?
Ans. 1.
13. What is the greatest common measure of 671, 2013 and 4026 ?
Ans. 671.
14. What is the greatest common measure of 16, 20 and 24 ?
Ans. 4.
15. What is the greatest common measure of 21, 27 and 81 ?
Ans. 3.

CASE II.

To reduce fractions to their lowest terms,

RULE.—Find the greatest common measure of the numerator and denominator, and with this divide both the factors, and their quotients will be the fraction in its lowest terms; or divide the numerator and denominator by any number that will divide them both without a remainder, and so continue until no number will divide them but unity, and the fraction will be in its lowest terms.

EXAMPLES.

1. Reduce $\frac{16}{48}$ to its lowest terms.
 $2) \frac{16}{48} = \frac{8}{24}$ $2) \frac{8}{24} = \frac{4}{12}$ $4) \frac{4}{12} = \frac{1}{3}$ Ans.
2. Reduce $\frac{16}{32}$ to its lowest terms. Ans. $\frac{1}{2}$.
3. Reduce $\frac{24}{32}$ to its lowest terms. Ans. $\frac{3}{4}$.
4. Reduce $\frac{36}{48}$ to its lowest terms. Ans. $\frac{3}{4}$.

- | | |
|--|-------------------------|
| 5. Reduce $1\frac{14}{10}$ to its lowest terms. | Ans. $2\frac{7}{5}$. |
| 6. Reduce $1\frac{5}{7}$ to its lowest terms. | Ans. $1\frac{5}{7}$. |
| 7. Reduce $1\frac{22}{11}$ to its lowest terms. | Ans. $2\frac{2}{1}$. |
| 8. Reduce $2\frac{17}{315}$ to its lowest terms. | Ans. $2\frac{1}{15}$. |
| 9. Reduce $3\frac{7}{8}$ to its lowest terms. | Ans. $3\frac{7}{8}$. |
| 10. Reduce $1\frac{11}{118}$ to its lowest terms. | Ans. $1\frac{1}{11}$. |
| 11. Reduce $3\frac{15}{11}$ to its lowest terms. | Ans. $4\frac{4}{11}$. |
| 12. Reduce $2\frac{16}{1018}$ to its lowest terms. | Ans. $2\frac{8}{509}$. |
| 13. Reduce $1\frac{23}{58}$ to its lowest terms. | Ans. $1\frac{23}{58}$. |

CASE III.

To reduce mixed numbers to improper fractions.

RULE.—Multiply the whole number of the fraction by the denominator and to the product add the numerator, and place the product over the denominator of the fraction.

EXAMPLES.

- | | | |
|---|--|------------------------------|
| 1. Reduce $17\frac{2}{5}$ to an improper fraction. | $\begin{array}{r} 71\frac{2}{5} \\ 5 \\ \hline 88 \\ \hline 5 \end{array}$ | Ans. $35\frac{2}{5}$. |
| 2. Reduce $16\frac{3}{11}$ to an improper fraction. | | Ans. $17\frac{9}{11}$. |
| 3. Reduce $14\frac{2}{7}$ to an improper fraction. | | Ans. $10\frac{2}{7}$. |
| 4. Reduce $126\frac{5}{7}$ to an improper fraction. | | Ans. $883\frac{5}{7}$. |
| 5. Reduce $149\frac{16}{137}$ to an improper fraction. | | Ans. $2042\frac{16}{137}$. |
| 6. Reduce $161\frac{1}{18}$ to an improper fraction. | | Ans. $290\frac{1}{18}$. |
| 7. Reduce $171\frac{5}{9}$ to an improper fraction. | | Ans. $1546\frac{5}{9}$. |
| 8. Reduce $98\frac{4}{7}$ to an improper fraction. | | Ans. $688\frac{4}{7}$. |
| 9. Reduce $116\frac{31}{1}$ to an improper fraction. | | Ans. $7107\frac{31}{1}$. |
| 10. Reduce $718\frac{4}{7}$ to an improper fraction. | | Ans. $5028\frac{4}{7}$. |
| 11. Reduce $100\frac{99}{100}$ to an improper fraction. | | Ans. $20099\frac{99}{100}$. |
| 12. Reduce $478\frac{1}{18}$ to an improper fraction. | | Ans. $8604\frac{1}{18}$. |

13. Reduce $871\frac{3}{116}$ to an improper fraction. Ans. $101039\frac{3}{116}$.
14. Reduce $167\frac{99}{117}$ to an improper fraction. Ans. $19639\frac{9}{117}$.
15. Reduce $613\frac{104}{307}$ to an improper fraction. Ans. $189292\frac{2}{307}$.
16. Reduce $159\frac{100}{201}$ to an improper fraction. Ans. $32059\frac{9}{201}$.
17. Reduce $999\frac{999}{1000}$ to an improper fraction. Ans. $999999\frac{999}{1000}$.

CASE IV.

To reduce improper fractions to whole or mixed numbers.

RULE.—Divide the numerator by the denominator, and if there be a remainder, place it over the denominator, at the right hand of the whole number.

EXAMPLES.

1. Reduce $\frac{117}{19}$ to a mixed number.

$$19)117(6\frac{3}{19} \text{ Ans.}$$

$$\begin{array}{r} 114 \\ \hline \end{array}$$

$$3$$

2. Reduce $\frac{167}{15}$ to a mixed number. Ans. $11\frac{2}{5}$.
3. Reduce $\frac{1631}{116}$ to a mixed number. Ans. $14\frac{7}{116}$.
4. Reduce $\frac{131}{17}$ to a mixed number. Ans. $7\frac{13}{17}$.
5. Reduce $\frac{917}{161}$ to a mixed number. Ans. $31\frac{34}{161}$.
6. Reduce $\frac{1161}{817}$ to a mixed number. Ans. $1\frac{344}{817}$.
7. Reduce $\frac{1851}{17}$ to a mixed number. Ans. $97\frac{2}{17}$.
8. Reduce $\frac{1610}{11}$ to a mixed number. Ans. 150.
9. Reduce $\frac{675}{51}$ to a mixed number. Ans. $13\frac{12}{51}$.
10. Reduce $\frac{1090}{9}$ to a mixed number. Ans. $111\frac{1}{9}$.
11. Reduce $\frac{9999}{100}$ to a mixed number. Ans. $99\frac{99}{100}$.
12. Reduce $\frac{4123}{45}$ to a mixed number. Ans. $91\frac{28}{45}$.
13. Reduce $\frac{67956}{7}$ to a mixed number. Ans. $9693\frac{4}{7}$.
14. Reduce $\frac{1009000}{1}$ to a mixed number. Ans. 1000000.

CASE V.

To reduce compound fractions to simple fractions.

RULE.—Reduce the mixed numbers, if there be any, to improper fractions, then multiply all the numerators together for a new numerator, and the denominators for a new denominator, and then reduce the fraction to its lowest terms.

EXAMPLES.

1. What is $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{7}{9}$ of $1\frac{1}{2}$?
 $\frac{2}{3} \times \frac{5}{8} \times \frac{7}{9} \times 1\frac{1}{2} = \frac{770}{729} = 3\frac{85}{81}$ Answer.
2. What is $\frac{5}{7}$ of $1\frac{1}{2}$ of $\frac{3}{4}$ of $1\frac{1}{8}$? Ans. $1\frac{11}{16}$.
3. What is $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{3}{4}$ of $1\frac{1}{3}$? Ans. $1\frac{15}{16}$.
4. What is $\frac{7}{11}$ of $\frac{1}{2}$ of $\frac{3}{4}$ of $2\frac{8}{10}$? Ans. $2\frac{28}{11}$.
5. What is $\frac{6}{11}$ of $\frac{7}{9}$ of $\frac{1}{4}$ of 21? Ans. $2\frac{1}{11}$.
6. What is $\frac{3}{5}$ of $1\frac{9}{17}$ of 265? Ans. $84\frac{3}{17}$.
7. What is $\frac{4}{11}$ of $2\frac{2}{3}$ of $\frac{6}{11}$ of 31? Ans. $5\frac{221}{11}$.
8. What is $2\frac{1}{2}$ of $1\frac{8}{9}$ of 1728? Ans. $1067\frac{2}{3}$.

NOTE.—If there be numbers in the numerator similar to those in the denominator, they may be cancelled in the operation.

9. What is $\frac{3}{4}$ of $\frac{4}{7}$ of $1\frac{7}{11}$ of $2\frac{1}{4}$? Ans. $2\frac{3}{4} = \frac{1}{2}$.
10. What is $\frac{3}{7}$ of $1\frac{7}{15}$ of $2\frac{5}{9}$ of $3\frac{2}{3}$? Ans. $1\frac{1}{11}$.
11. What is $\frac{7}{11}$ of $1\frac{1}{7}$ of $2\frac{7}{13}$ of $2\frac{3}{8}$? Ans. $\frac{1}{4}$.
12. What is $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $1\frac{5}{12}$ of 24? Ans. 2.

CASE VI.

To find the least common multiple of two or more numbers.

RULE.—Divide by any number, that will divide two or more of the given numbers without a remainder, and set the several quotients, with the several undivided numbers in a line beneath, and so continue to divide, until no number greater than unity will divide two or more of them. Then multiply all the divi-

sors, quotients, and undivided numbers together, and the product is the least common multiple.

EXAMPLES.

1. What is the least common multiple of 4, 6, 8, 16, and 20?

$$\begin{array}{r}
 4) 4 \ 6 \ 8 \ 16 \ 20 \\
 \hline
 2) 1 \ 6 \ 2 \ 4 \ 5 \\
 \hline
 1 \ 3 \ 1 \ 2 \ 5 \\
 2 \\
 \hline
 10 \\
 3 \\
 \hline
 30 \\
 2 \\
 \hline
 60 \\
 4 \\
 \hline
 240
 \end{array}$$

By this process, it appears, that 240 is the least number that may be divided by all the numbers in the question without a remainder.

$$\text{Ans. } 4 \times 2 \times 3 \times 2 \times 5 = 240.$$

2. What is the least common multiple of 6, 8, 10, 18, 20 and 24?

Ans. 360.

3. What is the least common multiple of 14, 19, 38 and 57?

Ans. 798.

4. What is the least common multiple of 20, 36, 48 and 50?

Ans. 3600.

5. What is the least common multiple of 15, 25, 35, 45 and 100?

Ans. 6300.

6. What is the least common multiple of 100, 200, 300, 400 and 575?

Ans. 27600.

I have four different measures, the first contains 4 quarts, the second 6 quarts, the third 10 quarts, and the fourth 12 quarts. How large is a vessel, that may be filled by each one of these, taken any number of times full?

Ans. 60 qts.

CASE VII.

To reduce any fractions to others, which shall have the least common denominator.

RULE.—Find the least common multiple of all the denominators, by Case 6, and it will be the denominator required. Divide this common multiple by each of the denominators, and multiply the several quotients by the respective numerators of the fraction, and their products will be the numerators required.

EXAMPLES.

1. Reduce $\frac{7}{8}$, $\frac{5}{12}$, and $\frac{1}{6}$ to fractions having the least common denominator.

| | | |
|-----------------|----|---|
| 4) 8 12 16 | 48 | Ans. $\frac{42}{48}$ $\frac{20}{48}$ $\frac{8}{48}$ |
| <u>2) 2 3 4</u> | 8 | $\frac{6 \times 7 = 42}{6 \times 7 = 42}$ |
| <u>1 3 2</u> | 12 | $\frac{4 \times 5 = 20}{4 \times 5 = 20}$ |
| 3 | 16 | $\frac{3 \times 11 = 33}{3 \times 11 = 33}$ |
| — | | |
| 6 | | |
| 2 | | |
| — | | |
| 12 | | |
| 4 | | |
| — | | |
| 48 | | |

2. Reduce $\frac{3}{4}$, $\frac{5}{8}$, $\frac{7}{8}$ and $\frac{5}{12}$. Ans. $\frac{45}{48}$, $\frac{30}{48}$, $\frac{35}{48}$, $\frac{20}{48}$.

3. Reduce $\frac{1}{11}$, $\frac{8}{15}$, $\frac{1}{20}$ and $\frac{5}{24}$. Ans. $\frac{720}{1320}$, $\frac{704}{1320}$, $\frac{1354}{1320}$, $\frac{275}{1320}$.

4. Reduce $\frac{1}{4}$, $\frac{3}{14}$, $\frac{9}{21}$ and $\frac{5}{28}$. Ans. $\frac{12}{84}$, $\frac{18}{84}$, $\frac{36}{84}$, $\frac{15}{84}$.

5. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$. Ans. $\frac{20}{60}$, $\frac{20}{60}$, $\frac{15}{60}$, $\frac{12}{60}$.

6. Reduce $\frac{1}{2}$, $\frac{3}{11}$, $\frac{1}{4}$ and $\frac{3}{5}$. Ans. $\frac{210}{440}$, $\frac{120}{440}$, $\frac{110}{440}$, $\frac{264}{440}$.

7. Reduce $\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{5}$ and $\frac{1}{6}$. Ans. $\frac{30}{60}$, $\frac{45}{60}$, $\frac{36}{60}$, $\frac{10}{60}$.

8. Reduce $\frac{1}{5}$, $\frac{3}{8}$, $\frac{5}{11}$ and $\frac{7}{11}$. Ans. $\frac{594}{5280}$, $\frac{396}{5280}$, $\frac{2475}{5280}$, $\frac{441}{5280}$.

9. Reduce $\frac{3}{4}$, $\frac{7}{8}$, $\frac{1}{2}$ and $3\frac{1}{4}$. Ans. $\frac{80}{120}$, $\frac{105}{120}$, $\frac{60}{120}$, $\frac{456}{120}$.
10. Reduce $\frac{1}{2}$, $\frac{3}{8}$, $\frac{4}{5}$ and $4\frac{3}{4}$. Ans. $\frac{70}{168}$, $\frac{63}{168}$, $\frac{96}{168}$, $\frac{788}{168}$.
11. Reduce $\frac{1}{4}$, $\frac{5}{12}$, $\frac{1}{3}$ and $\frac{1}{2}$. Ans. $\frac{25}{120}$, $\frac{50}{120}$, $\frac{40}{120}$, $\frac{60}{120}$.
12. Reduce $\frac{3}{8}$, $\frac{7}{12}$, $\frac{1}{6}$ and $2\frac{1}{4}$. Ans. $\frac{225}{288}$, $\frac{147}{288}$, $\frac{48}{288}$, $\frac{24}{288}$.
13. Reduce $\frac{1}{10}$, $\frac{3}{20}$, $\frac{1}{5}$ and $\frac{1}{10}$. Ans. $\frac{60}{600}$, $\frac{180}{600}$, $\frac{120}{600}$, $\frac{60}{600}$.
14. Reduce $\frac{1}{6}$, $\frac{1}{12}$, $\frac{1}{18}$ and $\frac{1}{20}$. Ans. $\frac{240}{240}$, $\frac{200}{240}$, $\frac{133\frac{1}{3}}{240}$, $\frac{84}{240}$.
15. Reduce $\frac{3}{8}$, 7 , 8 , and $5\frac{1}{4}$. Ans. $\frac{14}{64}$, $\frac{448}{64}$, $\frac{512}{64}$, $\frac{324}{64}$.

CASE VIII.

RULE.—To reduce fractions of different denominations to other fractions of the same value, having a common denominator :

Multiply each numerator into all the denominators except its own for a new numerator ; and all the denominators into each other for a common denominator.

EXAMPLES.

1. Reduce $\frac{3}{8}$, $\frac{4}{5}$ and $\frac{7}{6}$ to fractions having a common denominator
 $2 \times 5 \times 8 = 80$ the numerator for $\frac{3}{8}$
 $4 \times 3 \times 8 = 96$ the numerator for $\frac{4}{5}$
 $7 \times 3 \times 5 = 105$ the numerator for $\frac{7}{6}$

$$3 \times 5 \times 8 = 120 \text{ the common denominator.}$$

Therefore the required fractions will be $\frac{30}{120}$, $\frac{96}{120}$, $\frac{105}{120}$.

2. Reduce $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{3}{10}$. Ans. $\frac{30}{240}$, $\frac{90}{240}$, $\frac{72}{240}$.
3. Reduce $\frac{5}{12}$, $\frac{4}{9}$ and $\frac{2}{15}$. Ans. $\frac{545}{1080}$, $\frac{572}{1080}$, $\frac{516}{1080}$.
4. Reduce $\frac{1}{12}$, $\frac{4}{15}$, and $7\frac{3}{4}$. Ans. $\frac{364}{420}$, $\frac{182}{420}$, $\frac{4836}{420}$.
5. Reduce $\frac{1}{12}$, $\frac{1}{6}$ and $\frac{1}{15}$. Ans. $\frac{1485}{2520}$, $\frac{1020}{2520}$, $\frac{512}{2520}$.
6. Reduce $\frac{3}{8}$, $\frac{1}{12}$ and $11\frac{7}{15}$. Ans. $\frac{2040}{2520}$, $\frac{210}{2520}$, $\frac{28315}{2520}$.
7. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{4}{5}$ and 8 . Ans. $\frac{24}{120}$, $\frac{80}{120}$, $\frac{96}{120}$, $\frac{960}{120}$.
8. Reduce $\frac{1}{6}$, $\frac{7}{11}$ and $\frac{2}{3}$ of $7\frac{1}{2}$. Ans. $\frac{176}{396}$, $\frac{252}{396}$, $\frac{2012}{396}$.
9. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{4}$ and 17 . Ans. $\frac{24}{48}$, $\frac{32}{48}$, $\frac{12}{48}$, $\frac{816}{48}$.
10. Reduce $\frac{1}{12}$, $\frac{1}{6}$ of 6 and $21\frac{1}{2}$. Ans. $\frac{120}{120}$, $\frac{576}{120}$, $\frac{2580}{120}$.
11. Reduce $\frac{3}{11}$, $\frac{1}{13}$, $\frac{5}{17}$, $\frac{4}{19}$ and $\frac{1}{2}$.
 Ans. $\frac{12012}{14014}$, $\frac{5086}{14014}$, $\frac{5880}{14014}$, $\frac{8008}{14014}$, $\frac{7007}{14014}$.

12. Reduce $\frac{27}{169}$, $\frac{127}{611}$ and $\frac{7}{1729}$.

Ans. $\frac{28506816}{178431552}, \frac{37088064}{178431552}, \frac{722813}{178431552}$.

CASE IX.

To reduce fractions of a lower denomination to a higher, retaining the same value:

RULE.—Let the given fractions be reduced to a compound one by comparing it with all the denominations between the one given, and the one to which it is required to reduce it; then reduce this compound fraction to a simple one.

EXAMPLES.

1. Reduce $\frac{3}{4}$ of a penny to the fraction of a pound.
 $\frac{3}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{160}$ Ans. $\frac{1}{160}$.
2. Reduce $\frac{4}{5}$ of a farthing to the fraction of a pound.
 Ans. $\frac{1}{1250}$.
3. Reduce $\frac{3}{5}$ of a grain troy to the fraction of a pound.
 Ans. $\frac{1}{7500}$.
4. Reduce $\frac{5}{8}$ of a scruple to the fraction of a pound.
 Ans. $\frac{5}{2880}$.
5. Reduce $\frac{6}{11}$ of an ounce to the fraction of a hundred weight.
 Ans. $\frac{3}{550}$.
6. Reduce $\frac{3}{4}$ of a pound to the fraction of a ton.
 Ans. $\frac{3}{1600}$.
7. Reduce $\frac{1}{5}$ of an inch to the fraction of an ell English.
 Ans. $\frac{1}{225}$.
8. Reduce $\frac{4}{5}$ of an inch to the fraction of a mile.
 Ans. $\frac{1}{110880}$.
9. Reduce $\frac{1}{2}$ of a barley corn to the fraction of a league.
 Ans. $\frac{1}{1140480}$.
10. Reduce $\frac{3}{4}$ of an inch to the fraction of an acre.
 Ans. $\frac{3}{25080000}$.
11. Reduce $\frac{7}{8}$ of a quart to the fraction of a ton, wine measure.
 Ans. $\frac{1}{1152}$.
12. Reduce $\frac{3}{5}$ of a pint to the fraction of a bushel.
 Ans. $\frac{3}{320}$.
13. Reduce $\frac{1}{8}$ of a minute to the fraction of a year, (365 $\frac{1}{4}$ da.).
 Ans. $\frac{1}{4207800}$.

$$\frac{3}{8} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{1920} \quad \text{Ans. } \frac{1}{640}.$$

Ans. $\frac{1}{640}$.

2. Reduce $\frac{4}{5}$ of a farthing to the fraction of a pound.

Ans. $\frac{1}{1200}$.

3. Reduce $\frac{3}{4}$ of a grain troy to the fraction of a pound.

Ans. 7600 .

4. Reduce $\frac{5}{8}$ of a scruple to the fraction of a pound.

Ans. $2\frac{5}{92}$.

5. Reduce $\frac{6}{11}$ of an ounce to the fraction of a hundred weight.

Ans. $\frac{3}{55}$.

Ans. $9\frac{3}{55}$.

6. Reduce $\frac{3}{4}$ of a pound to the fraction of a ton.

Ans. $\frac{3}{8960}$.

7. Reduce $\frac{1}{4}$ of an inch to the fraction of an ell English.

Ans. $2\frac{1}{5}$.

8. Reduce $\frac{1}{4}$ of an inch to the fraction of a mile.

Ans. $\frac{1}{110880}$.

9. Reduce $\frac{1}{5}$ of a barley corn to the fraction of a league.

Ans. $\frac{1}{1140480}$.

10. Reduce $\frac{3}{4}$ of an inch to the fraction of an acre.

Ans. $\frac{3}{25090560}$.

11. Reduce $\frac{7}{8}$ of a quart to the fraction of a ton, wine measure. Ans. $\frac{1}{140}$.

Ans. $11\frac{1}{52}$.

12. Reduce $\frac{3}{5}$ of a pint to the fraction of a bushel.

Ans. $3\frac{2}{3}$.

13. Reduce $\frac{1}{8}$ of a minute to the fraction of a year, ($365\frac{1}{4}$ da.).

Ans. $420\frac{1}{680}$.

anything remain, multiply it by the next less denomination, and divide as before, and so continue as far as may be required; and the several quotients will be the answer.

EXAMPLES.

1. What is the value of $\frac{3}{11}$ of a pound?

Ans. 5s. 5d. $1\frac{2}{11}$ qr.

$$\begin{array}{r}
 3 \\
 20 \\
 \hline
 11) 60 \\
 \hline
 5 \quad 5 \\
 12 \\
 \hline
 11) 60 \\
 \hline
 5 \quad 5 \\
 4 \\
 \hline
 11) 20 \\
 \hline
 1\frac{2}{11}
 \end{array}$$

2. What is the value of $\frac{7}{24}$ of a shilling? Ans. $3\frac{1}{2}$ d.
 3. What is the value of $\frac{7}{9}$ of a guinea? Ans. 21s. 9d. $1\frac{1}{3}$ qr.
 4. What is the value of $\frac{7}{11}$ of a cwt.? Ans. 2qr. 15lb. 4oz. $5\frac{2}{11}$ dr.
 5. What is the value of $\frac{4}{5}$ of a lb. avoirdupois? Ans. 7oz. $1\frac{1}{5}$ dr.
 6. What is the value of $\frac{2}{3}$ of a lb. troy? Ans. 10oz. 13dwt. 8gr.
 7. What is the value of $\frac{4}{13}$ of a lb. apothecaries' weight? Ans. 3℥. 53. 1℔. $12\frac{4}{13}$ gr.
 8. What is the value of $\frac{7}{13}$ of a yard? Ans. 2qr. 0na. $1\frac{1}{13}$ in.
 9. What is the value of $\frac{2}{3}$ of an ell English? Ans. 2qr. 3na. $0\frac{1}{3}$ in.
 10. What is the value of $\frac{1}{3}$ of a mile? Ans. 6fur. 30rd. 12ft. $8\frac{1}{3}$ in.
 11. What is the value of $\frac{2}{3}$ of a furlong? Ans. 35rd. 9ft. 2in.

12. What is the value of $\frac{7}{13}$ of an acre?
 Ans. 2R. 6rd. 4yd. 5ft. $127\frac{5}{13}$ in.
 13. What is the value of $\frac{9}{17}$ of a rod? Ans. 144ft. $19\frac{1}{17}$ in.
 14. What is the value of $\frac{1}{13}$ of a cord?
 Ans. 9ft. $1462\frac{2}{13}$ in.
 15. What is the value of $\frac{2}{13}$ of a hhd. of wine?
 Ans. 6gall. 2qt. 1pt. $04\frac{4}{13}$ gi.
 16. What is the value of $\frac{7}{8}$ of a hhd. of beer? Ans. 42 gal.
 17. What is the value of $\frac{1}{13}$ of a year ($365\frac{1}{4}$ days)?
 Ans. 174d. 16h. 26m. $5\frac{5}{13}$ sec.
 18. What is the value of $7\frac{3\frac{3}{4}}{4\frac{2}{5}}$ of a dollar?
 Ans. \$7,744 $\frac{48}{121}$.

CASE XII.

To reduce any mixed quantity of weights, measures, &c. to the fraction of the integer:

RULE.—Reduce the given number to the lowest denomination it contains for a numerator; and then reduce the integers, to the same denomination for the denominator of the fraction required.

EXAMPLES.

1. Reduce 5s. 5d. $1\frac{2}{11}$ gr. to the fraction of a lb.

| | |
|-------|---|
| 20 | 5 5 $1\frac{2}{11}$ |
| 12 | 12 |
| — | — |
| 240 | 65 |
| 4 | 4 |
| — | — |
| 960 | 261 |
| 11 | 11 |
| — | — |
| 10560 | 2880 |
| | $\frac{2880}{10560} = \frac{2}{11}$ Answer. |

In this question, I reduce my shillings, pence, farthings, &c., to elevenths of a farthing, and also a pound to the same denomination, for a denominator. I then reduce the fraction to the lowest terms for a numerator.

2. Reduce $3\frac{1}{2}$ d. to the fraction of a shilling. Ans. $\frac{7}{4}$.
 3. Reduce 2ls. 9d. $1\frac{3}{4}$ qr. to the fraction of a guinea. Ans. $\frac{7}{8}$.
 4. Reduce 2qr. 14lb. 4oz. $4\frac{2}{11}$ dr. to the fraction of a cwt. Ans. $\frac{7}{11}$.

5. What part of a pound are 7oz. $1\frac{1}{2}$ dr. ? Ans. $\frac{1}{4}$.
6. What part of a pound troy are 10oz. 13dwt. 8gr. ? Ans. $\frac{8}{9}$.
7. What part of a pound apothecaries' weight are 3oz. 53gr. ? Ans. $\frac{1}{13}$.
8. What part of a yard are 2qr. 0na. $1\frac{1}{3}$ in. ? Ans. $\frac{1}{13}$.
9. What part of an ell-English are 2qr. 3na. $0\frac{1}{4}$ in. ? Ans. $\frac{5}{8}$.
10. What part of a mile are 6fur. 30rd. 12ft. 8in. $0\frac{1}{3}$ br. ? Ans. $\frac{1}{13}$.
11. Reduce 35rd. 9ft. 2in. to the fraction of a furlong. Ans. $\frac{8}{9}$.
12. What part of an acre are 2R. 6rd. 4yd. 5ft. $127\frac{1}{3}$ in. ? Ans. $\frac{1}{13}$.
13. What part of a square rod are 144ft. $19\frac{1}{17}$ in. ? Ans. $\frac{9}{19}$.
14. What part of a cord are 9ft. $1462\frac{2}{3}$ in. ? Ans. $\frac{1}{13}$.
15. What part of a hhd. of wine are 6gal. 2qt. 1pt. $0\frac{1}{8}$ gil. ? Ans. $\frac{1}{13}$.
16. What part of a hhd. of beer are 42gal. ? Ans. $\frac{7}{8}$.
17. What part of a year ($365\frac{1}{4}$) are 174da. 16h. 26m. $5\frac{5}{13}$ sec. ? Ans. $\frac{1}{13}$.

ADDITION OF VULGAR FRACTIONS.

CASE I.

If the fractions have a common denominator, add the numerators together, and place their sum over the denominator, and reduce its fraction to the lowest terms.

EXAMPLES.

1. Add $\frac{3}{12}$, $\frac{5}{12}$, $\frac{7}{12}$ and $\frac{11}{12}$ together. Ans. $2\frac{1}{2}$.

$$3+5+7+11=26 \quad \frac{26}{12} = 2\frac{1}{2}$$
2. Add $\frac{5}{17}$, $\frac{6}{17}$, $\frac{9}{17}$, $\frac{11}{17}$, $\frac{14}{17}$ and $\frac{18}{17}$ together. Ans. $3\frac{1}{2}$.
3. Add $\frac{4}{23}$, $\frac{9}{23}$, $\frac{11}{23}$, $\frac{13}{23}$ and $\frac{18}{23}$ together. Ans. $2\frac{1}{2}$.

4. Add $\frac{4}{87}$, $\frac{17}{87}$, $\frac{29}{87}$, $\frac{49}{87}$ and $\frac{77}{87}$ together. Ans. $2\frac{2}{87}$.
5. Add $\frac{11}{144}$, $\frac{19}{144}$, $\frac{29}{144}$ and $\frac{117}{144}$ together. Ans. $1\frac{3}{8}$.
6. Add $\frac{831}{831}$, $\frac{481}{831}$, $\frac{567}{831}$ and $\frac{11}{831}$ together. Ans. $24\frac{28}{831}$.
7. Add $\frac{781}{781}$, $\frac{741}{781}$, $\frac{689}{781}$ and $\frac{789}{781}$ together. Ans. $3\frac{787}{781}$.
8. Add $\frac{1976}{9116}$, $\frac{8747}{9116}$ and $\frac{7128}{9116}$ together. Ans. $14\frac{217}{9116}$.
9. Add $\frac{3366}{3376}$, $\frac{3333}{3376}$ and $\frac{3999}{3376}$ together. Ans. $21\frac{477}{3376}$.
10. Add $\frac{888}{1000}$, $\frac{888}{1000}$ and $\frac{777}{1000}$ together. Ans. $2\frac{5}{125}$.

CASE II.

If the numbers to be added have not a common denominator, &c.

RULE.—Reduce mixed numbers to improper fractions, and compound fractions to proper ones; then reduce all the fractions to a common denominator, and the sum of their numerators, placed over the common denominator, will be the answer required.

EXAMPLES.

1. Add $\frac{7}{8}$, $\frac{5}{12}$, $1\frac{1}{6}$ and $\frac{13}{20}$ together.

$$\begin{array}{r} 4)8 \quad 12 \quad 16 \quad 20 \\ \hline \end{array}$$

$$\begin{array}{r} 2)2 \quad 3 \quad 4 \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \quad 3 \quad 2 \quad 5 \\ \hline \end{array}$$

$$4 \times 2 \times 3 \times 2 \times 5 = \text{common denominator.}$$

$$240$$

$$\begin{array}{r} 8)30 \times 7 = 210 \\ \hline \end{array}$$

$$12)20 \times 8 = 160$$

$$16)15 \times 11 = 165$$

$$20)12 \times 12 = 156$$

$$\begin{array}{r} 691 \\ \hline \end{array}$$

$$\begin{array}{r} \hline = 2\frac{211}{240} \text{ Answer.} \end{array}$$

$$240$$

2. Add $\frac{1}{4}$, $\frac{7}{8}$, $1\frac{1}{2}$ and $\frac{5}{8}$ together. Ans. $24\frac{3}{8}$.
3. Add $\frac{7}{17}$, $\frac{2}{22}$, $\frac{9}{8}$ and $\frac{1}{6}$ together. Ans. $1\frac{281}{84}$.
4. Add $\frac{3}{10}$, $\frac{1}{18}$, $1\frac{1}{2}$ and $\frac{7}{8}$ together. Ans. $21\frac{33}{80}$.

5. Add $\frac{1}{17}$, $\frac{3}{24}$, $\frac{1}{138}$ and $\frac{1}{2}$ together. Ans. 1.
6. Add $\frac{1}{15}$, $\frac{1}{10}$, $\frac{1}{8}$ and $\frac{1}{10}$ together. Ans. $3\frac{1}{80}$.
7. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$ and $\frac{1}{7}$ together. Ans. $1\frac{23}{140}$.
8. Add $\frac{8}{9}$, $\frac{7}{8}$ and $5\frac{8}{9}$ together. Ans. $6\frac{23}{24}$.
9. Add $\frac{4}{11}$, $\frac{7}{22}$ and $9\frac{3}{11}$ together. Ans. $9\frac{3}{22}$.
10. Add $\frac{3}{4}$, $\frac{5}{8}$ and $4\frac{3}{4}$ together. Ans. $6\frac{1}{2}$.
11. Add $\frac{1}{5}$, $7\frac{1}{2}$ and $8\frac{1}{4}$ together. Ans. $17\frac{1}{20}$.
12. Add $\frac{7}{9}$, $3\frac{1}{4}$, and $5\frac{3}{4}$ together. Ans. $9\frac{11}{12}$.
13. Add $6\frac{3}{8}$, $7\frac{8}{9}$ and $4\frac{3}{8}$ together. Ans. $18\frac{11}{24}$.

NOTE.—If the fraction and number be mixed, the better way is to add their fractional parts separately, as in the following example.

14. What is the sum of $11\frac{3}{4}$, $15\frac{7}{8}$, $12\frac{5}{12}$ and $17\frac{1}{6}$?

$$4) 4 \ 8 \ 12 \ 6$$

$$4 \times 3 \times 2 = 24$$

$$\begin{array}{r} 3 \overline{) 12 \ 36} \\ 36 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \overline{) 12 \ 12} \\ 12 \\ \hline \end{array}$$

$$1 \ 1 \ 1 \ 1$$

$$\begin{array}{r} 11\frac{3}{4} \\ 15\frac{7}{8} \\ 12\frac{5}{12} \\ 17\frac{1}{6} \\ \hline \end{array}$$

$$18$$

$$21$$

$$10$$

$$20$$

$$\text{Answer} = 57\frac{7}{8}$$

$$69$$

$$- = 2\frac{1}{8}$$

$$24$$

15. What is the sum of $11\frac{1}{2}$, $19\frac{5}{12}$ and $23\frac{1}{3}$? Ans. $54\frac{23}{12}$.
16. What is the sum of $18\frac{1}{6}$, $27\frac{7}{10}$ and $49\frac{1}{2}$? Ans. 96.
17. What is the sum of $21\frac{1}{3}$, $18\frac{2}{3}$ and $26\frac{1}{3}$? Ans. $66\frac{1}{3}$.
18. What is the sum of $17\frac{2}{3}$, $14\frac{1}{2}$ and $13\frac{1}{2}$? Ans. $45\frac{1}{2}$.
19. What is the sum of $16\frac{2}{3}$, $8\frac{1}{6}$, $9\frac{1}{3}$, $3\frac{1}{2}$ and $1\frac{1}{6}$? Ans. $40\frac{1}{6}$.
20. What is the sum of $371\frac{1}{2}$, $614\frac{1}{2}$ and $81\frac{1}{2}$? Ans. $1068\frac{1}{2}$.

CASE III.

To add any two fractions, whose numerators are a unit.

RULE.—Place the sum of the denominators over their product.

EXAMPLES.

1. Add $\frac{1}{4}$ to $\frac{1}{5}$.

$$4 + 5 = 9$$

$$\frac{4 + 5}{4 \times 5} = \frac{9}{20} \quad \text{Answer.}$$

$$4 \times 5 = 20$$

2. Add $\frac{1}{8}$ to $\frac{1}{4}$.
3. Add $\frac{1}{12}$ to $\frac{1}{4}$.
4. Add $\frac{1}{11}$ to $\frac{1}{7}$.
5. Add $\frac{1}{10}$ to $\frac{1}{3}$.
6. Add $\frac{1}{2}$ to $\frac{1}{6}$.
7. Add $\frac{1}{4}$ to $\frac{1}{7}$.
8. Add $\frac{1}{5}$ to $\frac{1}{9}$.
9. Add $\frac{1}{7}$ to $\frac{1}{12}$.
10. Add $\frac{1}{3}$ to $\frac{1}{6}$.

If the numerators of the given fraction be alike, and more than a unit, the new numerator must be multiplied by one of them.

11. Add $\frac{3}{4}$ to $\frac{3}{5}$.

$$\begin{array}{r} 4+5=9 \times 3=27 \\ \hline 4 \times 5 = 20 \end{array} = 1\frac{7}{20} \text{ Answer.}$$

12. Add $\frac{4}{5}$ to $\frac{4}{7}$.
13. Add $\frac{4}{8}$ to $\frac{4}{11}$.
14. Add $\frac{5}{8}$ to $\frac{5}{7}$.
15. Add $\frac{6}{7}$ to $\frac{6}{8}$.
16. Add $\frac{7}{8}$ to $\frac{7}{9}$.
17. Add $\frac{8}{11}$ to $\frac{8}{13}$.
18. Add $\frac{9}{17}$ to $\frac{9}{20}$.
19. Add $\frac{10}{11}$ to $\frac{10}{19}$.
20. Add $\frac{11}{15}$ to $\frac{11}{16}$.

NOTE.—The above rule may be found very useful, because all similar questions may be readily performed *mentally*.

COMPOUND ADDITION OF VULGAR FRACTIONS.

1. Add $\frac{7}{8}$ of a £ to $\frac{8}{11}$ of a £.

Find $\frac{7}{8}$ of a £ = 10s. 9d. 0 $\frac{2}{3}$ qr.

And $\frac{8}{11}$ of a £ = 16s. 4d. 1 $\frac{5}{11}$ qr.

£1 7s. 1d. 2 $\frac{54}{11}$ qr.

2. Add together $\frac{1}{2}$ of a £, $\frac{1}{4}$ of a £, and $\frac{1}{8}$ of a shilling.
Ans. 17s. 10 $\frac{3}{4}$ d.
3. Add together $\frac{7}{11}$ of a ton, and $\frac{1}{12}$ of a cwt.
Ans. 13cwt. 2qr.
4. Add together $\frac{1}{2}$ of a yard, $\frac{1}{4}$ of an Ell English, and $\frac{1}{8}$ of a qr.
Ans. 3qr. 3na. 1 $\frac{1}{4}$ in.
5. Add together $\frac{7}{11}$ of a mile, $\frac{1}{12}$ of a furlong, and $\frac{1}{12}$ of a yard.
Ans. 5fur. 16rd. 0ft. 3in. 1 $\frac{1}{4}$ in.
6. A. has three house lots; the first contains $\frac{1}{2}$ of an acre, the second $\frac{1}{3}$ of an acre, and the third $\frac{1}{4}$ of an acre. How many acres do they all contain?
Ans. 2A. 1R. 9p. 142ft. 87 $\frac{1}{2}$ in.
7. A man travelled 18 $\frac{1}{2}$ miles the first day, 23 $\frac{1}{4}$ miles the second day, and 19 $\frac{1}{4}$ miles the third day. How far did he travel in the three days?
Ans. 61m. 2fur. 3rd. 13ft. 4 $\frac{1}{2}$ in.
8. Add $\frac{1}{12}$ of a gallon of wine to $\frac{1}{12}$ of a hhd.
Ans. 6gal. 0qt. 1pt. 1 $\frac{1}{2}$ gi.
9. Add $\frac{1}{16}$ of a week to $\frac{1}{5}$ of a day.
Ans. 2da. 9h. 18m.

SUBTRACTION OF VULGAR FRACTIONS.

CASE I.

When the fractions have a common denominator.

RULE.—Subtract the less numerator from the greater, and under the remainder place the common denominator, and reduce the fraction if necessary.

EXAMPLES.

1. Subtract $\frac{5}{12}$ from $\frac{1}{12}$.

$$\begin{array}{r} 11 \\ 5 \\ \hline 6 \\ \hline \end{array} = \frac{1}{12} \text{ Ans.}$$

2. Subtract $\frac{8}{17}$ from $\frac{1}{17}$.

$$\begin{array}{r} 12 \\ \hline \end{array} \text{ Ans. } \frac{1}{17}.$$

- | | |
|---|---------------------------|
| 3. Subtract $\frac{4}{15}$ from $\frac{13}{15}$. | Ans. $\frac{9}{15}$. |
| 4. Subtract $\frac{8}{37}$ from $\frac{23}{37}$. | Ans. $\frac{15}{37}$. |
| 5. Subtract $\frac{17}{38}$ from $\frac{18}{38}$. | Ans. $\frac{1}{38}$. |
| 6. Subtract $\frac{28}{28}$ from $\frac{23}{28}$. | Ans. $\frac{2}{28}$. |
| 7. Subtract $\frac{14}{37}$ from $\frac{29}{37}$. | Ans. $\frac{15}{37}$. |
| 8. Subtract $\frac{16}{31}$ from $\frac{30}{31}$. | Ans. $\frac{14}{31}$. |
| 9. Subtract $\frac{116}{137}$ from $\frac{119}{137}$. | Ans. $\frac{3}{137}$. |
| 10. Subtract $\frac{1}{100}$ from $\frac{26}{100}$. | Ans. $\frac{1}{100}$. |
| 11. Subtract $\frac{14}{24}$ from $\frac{20}{24}$. | Ans. $\frac{1}{6}$. |
| 12. Subtract $\frac{16}{144}$ from $\frac{36}{144}$. | Ans. $\frac{5}{36}$. |
| 13. Subtract $\frac{19}{160}$ from $\frac{47}{160}$. | Ans. $\frac{7}{40}$. |
| 14. Subtract $\frac{327}{1728}$ from $\frac{596}{1728}$. | Ans. $\frac{269}{1728}$. |
| 15. Subtract $\frac{48}{1000}$ from $\frac{100}{1000}$. | Ans. $\frac{13}{125}$. |

CASE II.

To subtract fractions whose denominators are unlike.

RULE.—Reduce compound fractions to simple ones, and mixed ones to improper fractions; then having found a common denominator, divide this by each of the denominators of the fraction, and multiply their quotients by their respective numerators. The difference of these products, placed over the common denominator, will give the answer required.

EXAMPLES.

1. Subtract
- $\frac{4}{7}$
- from
- $\frac{11}{7}$
- .

Common denominator 77

$$\begin{array}{r|l}
 11 & 7 \times 10 = 70 \\
 7 & 11 \times 4 = 44 \\
 \hline
 & 26 \\
 \hline
 & = \text{Answer.} \\
 & 77
 \end{array}$$

- | | |
|---|-------------------------|
| 2. From $\frac{7}{12}$ take $\frac{2}{3}$. | Ans. $\frac{13}{12}$. |
| 3. From $\frac{8}{9}$ take $\frac{3}{8}$. | Ans. $\frac{37}{72}$. |
| 4. From $\frac{5}{8}$ take $\frac{1}{3}$. | Ans. $\frac{1}{24}$. |
| 5. From $\frac{12}{14}$ take $\frac{5}{34}$. | Ans. $\frac{19}{119}$. |
| 6. From $\frac{7}{10}$ take $\frac{5}{12}$. | Ans. $\frac{17}{60}$. |

- | | |
|--|-------------------------|
| 7. From $1\frac{1}{7}$ take $\frac{5}{9}$. | Ans. $1\frac{24}{63}$. |
| 8. From $1\frac{1}{8}$ take $\frac{3}{8}$. | Ans. $\frac{5}{8}$. |
| 9. From $1\frac{1}{11}$ take $\frac{4}{11}$. | Ans. $\frac{7}{11}$. |
| 10. From $\frac{31}{50}$ take $\frac{1}{10}$. | Ans. $\frac{21}{50}$. |
| 11. From $1\frac{1}{5}$ take $\frac{7}{10}$. | Ans. $1\frac{3}{10}$. |
| 12. From $1\frac{1}{9}$ take $\frac{5}{18}$. | Ans. $\frac{1}{6}$. |
| 13. From $\frac{3}{8}$ take $\frac{3}{8}$. | Ans. $\frac{3}{8}$. |

CASE III.

To subtract a fraction or mixed number from a whole number.

RULE.—Subtract the numerator from the denominator of the fraction, and under the remainder place the denominator, and carry one to be subtracted from the minuend.

EXAMPLES.

| 1. | 2. | 3. | 4. | 5. | 6. |
|------------------|------------------|---------------------|--------------------|---------------------------|------------------|
| 32 | 16 | 671 | 385 | 16 | 18 |
| $5\frac{3}{8}$ | $4\frac{1}{2}$ | $0\frac{4}{50}$ | $16\frac{1}{10}$ | $0\frac{1}{2}\frac{1}{7}$ | $1\frac{1}{2}$ |
| <hr/> | <hr/> | <hr/> | <hr/> | <hr/> | <hr/> |
| 26 $\frac{5}{8}$ | 11 $\frac{1}{2}$ | 670 $\frac{46}{50}$ | 368 $\frac{9}{10}$ | 15 $\frac{13}{14}$ | 16 $\frac{1}{2}$ |

7. From a hhd. of wine there leaked out $7\frac{2}{11}$ galls.; what quantity remained? Ans. $55\frac{2}{11}$ gal.

8. A man engaged to labor 30 days, but was absent $5\frac{1}{2}$ days; how many days did he work? Ans. $24\frac{1}{2}$ da.

9. From 144 pounds of sugar there was taken at one time $17\frac{1}{2}$ pounds, and at another $28\frac{1}{2}$ pounds; what quantity remains? Ans. $97\frac{1}{2}$ lb.

10. A man sells $9\frac{1}{2}$ yards from a piece of cloth containing 34 yards; how many yards remain? Ans. $24\frac{1}{2}$ yd.

11. The distance from Boston to Providence is 40 miles. A. having set out from Boston, has travelled $\frac{2}{7}$ of the distance; and B. having set out at the same time from Providence, has gone $\frac{2}{7}$ of the distance; how far is A. from B. ?

Ans. $28\frac{4}{7}$ m.

CASE IV.

To subtract one fraction from another, when both fractions have a unit for a numerator.

RULE.—Place the difference of the denominators over their product.

EXAMPLES.

$$\begin{array}{r} 1. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{3}. \qquad 7-3 \\ \hline \qquad \qquad \qquad = \frac{4}{21} \text{ Answer.} \\ 7 \times 3 \end{array}$$

$$2. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{4}.$$

$$3. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{6}.$$

$$4. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{5}.$$

$$5. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{2}.$$

$$6. \text{ Take } \frac{1}{11} \text{ from } \frac{1}{10}.$$

$$7. \text{ Take } \frac{1}{3} \text{ from } \frac{1}{2}.$$

$$8. \text{ Take } \frac{1}{12} \text{ from } \frac{1}{4}.$$

$$9. \text{ Take } \frac{1}{6} \text{ from } \frac{1}{3}.$$

$$10. \text{ Take } \frac{1}{10} \text{ from } \frac{1}{8}.$$

NOTE.—If the numerators of the given fractions be alike, and more than a unit, the new numerator must be multiplied by one of them.

$$\begin{array}{r} 11. \text{ Take } \frac{2}{3} \text{ from } \frac{2}{3}. \qquad 7-3 = 4 \times 2 \\ \hline \qquad \qquad \qquad = \frac{8}{21} \text{ Answer.} \\ 7 \times 3 = 21 \end{array}$$

$$12. \text{ Take } \frac{2}{3} \text{ from } \frac{2}{4}.$$

$$13. \text{ Take } \frac{2}{3} \text{ from } \frac{2}{5}.$$

$$14. \text{ Take } \frac{2}{3} \text{ from } \frac{2}{6}.$$

$$15. \text{ Take } \frac{2}{11} \text{ from } \frac{2}{7}.$$

$$16. \text{ Take } \frac{2}{11} \text{ from } \frac{2}{5}.$$

$$17. \text{ Take } \frac{2}{11} \text{ from } \frac{2}{8}.$$

$$18. \text{ Take } \frac{2}{11} \text{ from } \frac{2}{15}.$$

$$19. \text{ Take } \frac{2}{13} \text{ from } \frac{2}{7}.$$

$$20. \text{ Take } \frac{2}{13} \text{ from } \frac{2}{5}.$$

The above questions, and those of a similar kind, may be readily performed mentally.

COMPOUND SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Let the fractions be properly reduced, as in the foregoing rules.

EXAMPLES.

1. From $\frac{7}{11}$ of a £ take $\frac{2}{3}$ of a £.

| | |
|---|--------------------------------------|
| $\frac{7}{11}\text{£} = 12\text{s. } 8\frac{8}{11}$ | 33 = common denom. of the fractions. |
| $\frac{2}{3}\text{£} = 4\frac{5}{3}$ | — |
| <hr style="width: 50%; margin: 0;"/> | 24 |
| 8 $3\frac{1}{3}$ | 11 |
| | — |
| | 13 |
| | — |
| | 33 |

Ans. 8s. $3\frac{1}{3}$ d.

2. From $\frac{2}{3}$ of a ton take $\frac{1}{4}$ of a cwt.

Ans. 2cwt. 1qr. 3lb. 0oz. $3\frac{1}{5}$ dr.

3. From $\frac{7}{8}$ of an ell English take $\frac{2}{3}$ of a yard.

Ans. 3qr. 0na. $2\frac{5}{8}$ in.

4. From $\frac{2}{3}$ of a mile take $\frac{7}{11}$ of a furlong.

Ans. 1fur. 5rd. 10ft. 10in.

5. From $\frac{1}{4}$ of a degree take $\frac{2}{3}$ of a mile.

Ans. 49m. 0fur. 13rd. 11ft. 9in. $1\frac{7}{8}$ br.

6. From $\frac{1}{11}$ of an acre take $\frac{1}{3}$ of a rod.

Ans. 1R. 17p. 22yd. 2ft. 108in.

7. From $\frac{2}{10}$ of a cord take $\frac{2}{11}$ of a cord.

Ans. 91ft. $1602\frac{1}{5}$ in.

8. From $\frac{7}{13}$ of a hhd. of wine there leaked out $\frac{1}{4}$ of it; what remained?

Ans. 6gal. 3qt. 0pt. $1\frac{7}{5}$ gi.

9. From Boston to Concord, N. H. the distance is 72 miles; having travelled $\frac{1}{4}$ of this distance, how much remains?

Ans. 30m. 6fur. 34rd. 4ft. 8in. $1\frac{1}{2}$ br.

10. From $\frac{2}{3}$ of a year take $\frac{1}{4}$ of a week.

Ans. 101da. 5h. 54m. $17\frac{1}{2}$ sec.

11. From $\frac{1}{11}$ of an acre take $\frac{1}{2}$ of a foot.

Ans. 1R. 18p. 5yd. 4ft. 0in.

MULTIPLICATION OF VULGAR FRACTIONS.

CASE I.

When neither of the fractions are whole numbers.

RULE.—Prepare the fractions as in Addition, and multiply the numerators for a new numerator, and the denominators for a new denominator; if the result be an improper fraction, reduce it to its equivalent whole number.

EXAMPLES.

- | | | |
|---|-------------------|--------------------------|
| 1 Multiply $\frac{7}{8}$ by $\frac{3}{5}$. | $7 \times 3 = 21$ | |
| | <hr/> | |
| | $8 \times 5 = 40$ | Ans. $\frac{21}{40}$. |
| 2. Multiply $\frac{4}{11}$ by $\frac{2}{3}$. | | Ans. $\frac{8}{33}$. |
| 3. Multiply $\frac{3}{7}$ by $\frac{1}{2}$. | | Ans. $\frac{3}{14}$. |
| 4. Multiply $\frac{4}{5}$ by $\frac{6}{11}$. | | Ans. $\frac{24}{55}$. |
| 5. Multiply $\frac{7}{12}$ by $\frac{1}{16}$. | | Ans. $\frac{7}{192}$. |
| 6. Multiply $\frac{3}{11}$ by $\frac{1}{4}$. | | Ans. $\frac{3}{44}$. |
| 7. Multiply $\frac{3}{4}$ by $\frac{5}{8}$. | | Ans. $\frac{15}{32}$. |
| 8. Multiply $\frac{1}{7}$ by $\frac{1}{12}$. | | Ans. $\frac{1}{84}$. |
| 9. Multiply $\frac{2}{7}$ by $8\frac{3}{4}$. | | Ans. $3\frac{3}{4}$. |
| 10. Multiply $\frac{2}{10}$ by $17\frac{3}{11}$. | | Ans. $15\frac{6}{11}$. |
| 11. Multiply $\frac{8}{9}$ by $71\frac{1}{2}$. | | Ans. $63\frac{2}{3}$. |
| 12. Multiply $8\frac{7}{8}$ by $11\frac{3}{8}$. | | Ans. $100\frac{1}{4}$. |
| 13. Multiply $161\frac{1}{5}$ by $19\frac{1}{5}$. | | Ans. $3136\frac{1}{5}$. |
| 14. Multiply $\frac{3}{4}$ of $9\frac{1}{4}$ by $\frac{2}{3}$ of 17. | | Ans. $78\frac{1}{2}$. |
| 15. Multiply $\frac{2}{10}$ of 7 by $\frac{1}{5}$ of $87\frac{3}{11}$. | | Ans. $403\frac{3}{11}$. |
| 16. A merchant owns $\frac{7}{8}$ of a ship; he sells $\frac{1}{11}$ of his share to A. What part is that of the whole? | | Ans. $\frac{7}{22}$. |

CASE II.

To multiply a mixed number by a whole number.

RULE.—Multiply the numerator of the mixed number by the whole number, and divide the product by the denominator

of the fraction, and as many times as it contains the denominator, so many units must be carried to the product of the integers. If, after division, anything remains, let it be a numerator and the divisor a denominator to a fraction to be affixed to the product.

EXAMPLES.

1. Multiply $7\frac{5}{8}$ by 9.

$7\frac{5}{8}$

9

—

$68\frac{5}{8}$ Answer.

In performing this question, we multiply the 5 of the numerator by the multiplier 9, and find the product to be 45. This product we divide by 8, the denominator of the fraction, and find the quotient to be 5, which we carry to the product of 9 times 7. The remainder 5 we place over the divisor 8.

- | | |
|--|---------------------------------|
| 2. Multiply $8\frac{3}{4}$ by 7. | Ans. $60\frac{1}{4}$. |
| 3. Multiply $7\frac{3}{4}$ by 8. | Ans. $75\frac{3}{4}$. |
| 4. Multiply $11\frac{1}{2}$ by 7. | Ans. $82\frac{1}{2}$. |
| 5. Multiply $15\frac{2}{11}$ by 7. | Ans. $108\frac{2}{11}$. |
| 6. Multiply $14\frac{3}{8}$ by 9. | Ans. $131\frac{3}{8}$. |
| 7. Multiply $23\frac{3}{8}$ by 11. | Ans. $257\frac{3}{8}$. |
| 8. Multiply $47\frac{3}{11}$ by 15. | Ans. $709\frac{3}{11}$. |
| 9. Multiply $37\frac{1}{4}$ by 18. | Ans. $679\frac{1}{4}$. |
| 10. Multiply $678\frac{1}{2}$ by 24. | Ans. 16294. |
| 11. What will $23\frac{1}{8}$ pounds of lead cost, at 8 cents a pound? | Ans. \$1.91. |
| 12. What will $15\frac{1}{8}$ pounds of sugar cost, at 12 cents a pound? | Ans. \$1.88 $\frac{1}{4}$. |
| 13. What will $29\frac{5}{8}$ cwt. of hay cost, at \$1 12 per cwt.? | Ans. \$32.94 $\frac{3}{8}$. |
| 14. What will $9\frac{3}{4}$ yards of broadcloth cost, at \$8 per yard? | Ans. \$79.00. |
| 15. What will $17\frac{2}{8}$ tons of potash cost, at \$97 per ton? | Ans. \$1703.56 $\frac{1}{4}$. |
| 16. What will $3\frac{17}{112}$ tons of plaster of Paris cost, at \$12.75 per ton? | Ans. \$40.18 $\frac{59}{112}$. |
| 17. What will $17\frac{1}{12}$ dozen candles cost, at 16 cts. a dozen? | Ans. \$2.78 $\frac{1}{3}$. |

18. What will $27\frac{3}{4}$ pounds of bar soap cost, at 7 cts. a pound?
 Ans. \$1,91 $\frac{1}{2}$.
19. What will $29\frac{1}{2}$ dozen of axes cost, at \$11,62 per dozen?
 Ans. \$343,75 $\frac{1}{2}$.
20. Bought 28 bales of cotton cloth, each bale containing $31\frac{3}{4}$ yards; what will be the cost, at 16 cts. per yard?
 Ans. \$140,56.
-

DIVISION OF VULGAR FRACTIONS.

CASE I.

When neither of the fractions are whole numbers.

RULE.—Prepare the fractions as in addition; invert the divisor, and proceed as in multiplication.

EXAMPLES.

1. Divide $\frac{4}{7}$ by $\frac{3}{8}$ $\frac{4}{7} \times \frac{8}{3} = \frac{32}{21} \times 1\frac{1}{21}$ Answer.
2. Divide $\frac{7}{15}$ by $\frac{8}{9}$ $\frac{7}{15} \times \frac{9}{8} = \frac{63}{120} = \frac{21}{40}$. Answer.
3. Divide $1\frac{1}{2}$ by $\frac{3}{4}$. Ans. $1\frac{2}{3}$.
4. Divide $\frac{3}{4}$ by $1\frac{2}{3}$. Ans. $1\frac{7}{2}$.
5. Divide $\frac{8}{9}$ by $\frac{8}{9}$. Ans. $1\frac{8}{8}$.
6. Divide $1\frac{1}{5}$ by $1\frac{7}{1}$. Ans. $1\frac{16}{5}$.
7. Divide $\frac{2}{5}$ by $1\frac{4}{7}$. Ans. $\frac{68}{75}$.
8. Divide $2\frac{1}{5}$ by $1\frac{7}{15}$. Ans. $11\frac{7}{7}$.
9. Divide $2\frac{2}{5}$ by $7\frac{2}{5}$. Ans. $\frac{36}{75}$.
10. Divide $\frac{2}{11}$ by $16\frac{4}{5}$. Ans. $\frac{18}{407}$.
11. Divide $11\frac{7}{8}$ by $\frac{4}{7}$. Ans. 20.
12. Divide $21\frac{4}{5}$ by $18\frac{4}{5}$. Ans. $1\frac{11}{5}$.
13. Divide $17\frac{3}{11}$ by $28\frac{1}{11}$. Ans. $\frac{49}{28}$.
14. Divide $161\frac{3}{7}$ by $14\frac{2}{5}$. Ans. $11\frac{42}{11}$.
15. Divide $\frac{7}{11}$ of $\frac{4}{5}$ by $\frac{2}{5}$ of $\frac{8}{11}$. Ans. $1\frac{1}{5}$.

16. Divide $\frac{3}{4}$ of $7\frac{2}{11}$ by $\frac{4}{11}$ of $17\frac{3}{4}$.

Ans. $38\frac{1}{2}$.

17. Divide $\frac{6}{17}$ of 15 by $\frac{7}{15}$ of 22.

Ans. $13\frac{7}{10}$.

18. Bought $\frac{1}{4}$ of a coal mine for \$3,675, and having sold $\frac{1}{4}$ of it, I gave $\frac{3}{4}$ of the remainder to a charitable society, and divided the residue between 7 poor persons; what was the share of each?

Ans. \$50 for each poor person.

19. Of an estate valued at \$5000, the widow receives $\frac{1}{4}$, the oldest son $\frac{3}{4}$ of the remainder; the residue is equally divided between 7 daughters; what is the share of each daughter?

Ans. \$158 $\frac{1}{3}$.

CASE II.

To divide a whole number by a fraction.

RULE.—Multiply the whole number by the denominator of the fraction, and divide the product by the numerator.

EXAMPLES.

1. Divide 17 by $\frac{2}{4}$

$$\begin{array}{r} 17 \\ 4 \\ \hline 3) 68 \\ \hline 22\frac{2}{3}. \text{ Ans.} \end{array}$$

2. Divide 18 by $\frac{1}{11}$.

Ans. $28\frac{2}{11}$.

3. Divide 28 by $\frac{1}{15}$.

Ans. $41\frac{1}{15}$.

4. Divide 27 by $\frac{1}{17}$.

Ans. 459.

5. Divide 128 by $\frac{2}{15}$.

Ans. 960.

6. Divide 98 by $\frac{1}{11}$.

Ans. $151\frac{5}{11}$.

7. Divide 19 by $\frac{1}{13}$.

Ans. $31\frac{3}{13}$.

8. Divide 167 by $\frac{1}{18}$.

Ans. $200\frac{2}{9}$.

9. Divide 49 by $\frac{1}{18}$.

Ans. $88\frac{1}{9}$.

10. Divide 15 by $\frac{1}{15}$.

Ans. 225.

CASE III.

To divide a fraction by a whole number.

RULE.—Multiply the whole number by the denominator of the fraction, and place the product under the numerator.

EXAMPLES.

- | | |
|----------------------------------|--------------------------------------|
| 1. Divide $\frac{3}{4}$ by 17. | $4 \times 17 = \frac{3}{68}$ Answer. |
| 2. Divide $\frac{7}{11}$ by 18. | Ans. $\frac{7}{198}$. |
| 3. Divide $\frac{1}{2}$ by 28. | Ans. $\frac{1}{56}$. |
| 4. Divide $\frac{1}{17}$ by 27. | Ans. $\frac{1}{459}$. |
| 5. Divide $\frac{2}{15}$ by 128. | Ans. $\frac{1}{8640}$. |
| 6. Divide $\frac{1}{17}$ by 98. | Ans. $\frac{1}{1666}$. |
| 7. Divide $\frac{1}{2}$ by 19. | Ans. $\frac{1}{38}$. |
| 8. Divide $\frac{5}{8}$ by 167. | Ans. $\frac{5}{1336}$. |
| 9. Divide $\frac{1}{2}$ by 49. | Ans. $\frac{1}{98}$. |
| 10. Divide $\frac{1}{15}$ by 15. | Ans. $\frac{1}{225}$. |

CASE IV.

To divide a mixed fraction by a whole number.

RULE.—Divide the integer as in whole numbers, and if anything remains, multiply it by the denominator of the fraction, and to the product add the numerator of the fraction and place it over the product of the divisor, multiplied by the denominator.

EXAMPLES.

- | | |
|---|--|
| 1. Divide $27\frac{3}{5}$ by 6 | We divide the 27 by 6, and find it is contained 4 times, and that 3 remains, which we multiply by the denominator 5, and to the product we add the numerator 4, which amounts to 18; this we place over the product of 6, the divisor, multiplied by the denominator 5, which is 30. |
| $\begin{array}{r} 6 \overline{) 27\frac{3}{5}} \\ \underline{24} \phantom{\frac{3}{5}} \\ 3\frac{3}{5} \end{array}$ | |
| 2. Divide $29\frac{3}{8}$ by 9. | Ans. $3\frac{1}{2}$. |
| 3. Divide $14\frac{1}{2}$ by 7. | Ans. $2\frac{1}{4}$. |
| 4. Divide $13\frac{3}{8}$ by 8. | Ans. $1\frac{3}{4}$. |
| 5. Divide $14\frac{3}{8}$ by 6. | Ans. $2\frac{1}{8}$. |
| 6. Divide \$37 $\frac{3}{4}$ between 9 men. | Ans. $4\frac{1}{8}$. |
| 7. Divide \$96 $\frac{3}{4}$ between 11 persons. | Ans. $8\frac{3}{4}$. |
| 8. What is $\frac{1}{8}$ of $167\frac{7}{11}$ of iron? | Ans. $20\frac{1}{22}$. |

9. Divide $\frac{7}{8}$ of a prize, valued at \$1723, equally between 12 seamen.

Ans. \$125,63 $\frac{1}{4}$.

10. What will a barrel of flour cost, if 19 barrels can be purchased for \$107 $\frac{3}{4}$?

Ans. \$5,65 $\frac{3}{8}$.

11. If 15 pounds of raisins can be obtained for \$3 $\frac{3}{4}$, what will 1 pound cost?

Ans. \$0,21 $\frac{1}{4}$.

12. If 5 bushels of wheat cost 8 $\frac{3}{8}$; what will a bushel be worth?

Ans. \$1,64 $\frac{1}{2}$.

13. If 12 quarts of wine cost \$3,75 $\frac{3}{4}$; what will a quart cost?

Ans. \$0,31 $\frac{5}{8}$.

14. If \$19 will buy 375 $\frac{1}{2}$ acres of land; how much can be bought for \$1?

Ans. 19 $\frac{3}{4}$ A.

MISCELLANEOUS QUESTIONS.

1. How far will a man walk in 17 $\frac{3}{4}$ hours, provided he goes at the rate of 4 $\frac{1}{2}$ miles an hour?

Ans. 82m. 4fur. 8rd. 1ft. 4in.

2. How much land is there in a field, which is 29 $\frac{7}{8}$ rods square?

Ans. 5A. 1R. 32p. 141ft. 109 $\frac{1}{2}$ in.

3. How much wood in a pile, which is 17 $\frac{3}{4}$ feet long, 7 $\frac{1}{4}$ feet high, and 4 $\frac{3}{4}$ feet wide?

Ans. 4cd. 66 $\frac{1}{2}$ ft.

4. What is the value of 19 $\frac{1}{2}$ barrels of flour, at \$6 $\frac{1}{2}$ a barrel?

Ans. \$134,15 $\frac{1}{2}$.

5. What is the value of 376 $\frac{1}{2}$ acres of land, at \$75 $\frac{3}{8}$ per acre?

Ans. \$28,387,06 $\frac{1}{4}$.

6. What cost 17 $\frac{1}{2}$ quintals of fish, at \$4,75 per quintal?

Ans. \$81,55 $\frac{3}{4}$.

7. What cost 1670 $\frac{7}{8}$ pounds of coffee, at 12 $\frac{3}{4}$ cents per lb?

Ans. \$212,99 $\frac{1}{2}$.

8. What cost 28 $\frac{1}{4}$ tons of Lackawana coal, at \$11 $\frac{1}{2}$ a ton?

Ans. \$333,27 $\frac{3}{4}$.

9. Bought 37 $\frac{1}{2}$ hhds. of molasses, at \$17,62 $\frac{1}{2}$ a hhd; what was the whole cost?

Ans. \$655,19 $\frac{1}{2}$.

10. What cost $\frac{7}{8}$ of a cord of wood, at \$5,75 a cord?

Ans. \$5,3 $\frac{1}{8}$.

11. What is the contents of a field, which is 139 $\frac{1}{4}$ rods long, and 38 $\frac{1}{4}$ rods wide?

Ans. 33A. 3R. 15p.

12. Bought 15 loads of wood, each containing $11\frac{3}{4}$ feet, cord measure. I divide it equally between 9 persons, what does each receive?
Ans. $19\frac{1}{3}$ ft.

13. If the transportation of $18\frac{3}{4}$ tons of iron cost \$48, $15\frac{3}{4}$, what is it per ton?
Ans. \$2, $62\frac{1}{4}$ ¢.

14. If a hhd. of wine cost \$98 $\frac{7}{8}$, what is the price of one gallon?
Ans. \$1, $56\frac{1}{2}$ ¢.

15. What will 11 hhds. and $17\frac{1}{2}$ gallons of wine cost, at $19\frac{3}{4}$ cents a gallon?
Ans. \$140, $32\frac{3}{4}$ ¢.

16. How many bottles, each containing $1\frac{1}{4}$ pints, are sufficient for bottling a hhd. of cider?
Ans. 288 bottles.

17. What will $6\frac{7}{8}$ pounds of tea cost, at $65\frac{3}{4}$ cents per lb?
Ans. \$4, $52\frac{1}{2}$ ¢.

18. I have a shed, which is $18\frac{7}{12}$ feet long, $10\frac{5}{12}$ feet wide, and $7\frac{1}{2}$ feet high; how many cords of wood will it contain?
Ans. 11 cd. $124\frac{8}{17}, 2\frac{9}{8}$ in.

19. How many cubic feet does a box contain, that is $8\frac{3}{4}$ feet long, $5\frac{7}{12}$ feet wide, and 3 feet high?
Ans. $146\frac{2}{15}$ ft.

20. How many feet of boards will it take to cover a side of a house, which is $46\frac{5}{12}$ feet long, and $17\frac{1}{2}$ feet high?
Ans. $812\frac{7}{12}$ ft.

21. How many feet of boards will it take to make 7 boxes, that shall be $5\frac{1}{2}$ feet long, $2\frac{5}{12}$ feet high, $3\frac{1}{12}$ feet wide; and how many cubic feet will they contain?
Ans. $475\frac{25}{144}$ ft. $286\frac{2}{3}$ cub. ft.

22. A certain room is 12 feet long, $11\frac{1}{2}$ feet wide, and $7\frac{1}{2}$ feet high; how much will it cost to plaster it, at $2\frac{3}{4}$ cents per square foot?
Ans. \$13, $48\frac{3}{8}$ ¢.

23. A man has a garden that is $14\frac{1}{2}$ rods long, and $10\frac{1}{4}$ rods wide; he wishes to have a ditch dug around it, that shall be 3 feet wide, and $4\frac{1}{2}$ feet deep; what will be the expense, if he gives 2 cents per cubic foot?
Ans. \$223, $76\frac{1}{4}$ ¢.

24. How many bushels of grain will a box contain, which is $14\frac{7}{12}$ feet long, $5\frac{1}{12}$ feet deep, and $4\frac{1}{4}$ feet wide, there being $2150\frac{7}{8}$ cubic inches in a bushel?
Ans. $294\frac{3}{4}, 4\frac{3}{4}$ bush.

25. Which will contain the most, and by how much,—a box that is 10 feet long, 8 feet wide, and 6 feet deep; or a cubical one, whose each side measures 8 feet?

Ans. The last contains 32 cubic feet most.

DECIMAL FRACTIONS.

A Decimal Fraction is that, whose integer is always divided into 10, 100, 1000, &c. equal parts. Its denominator is always an unit, with as many ciphers annexed, as there are places in the given decimal. There is therefore no need of having the denominator *expressed*; for the value of the fraction is always known by placing a point before it, at the left hand, called the separatrix. Thus, .5 is $\frac{5}{10}$, .37 is $\frac{37}{100}$, .348 is $\frac{348}{1000}$.

Ciphers annexed to the right hand of decimals do not increase their value; for .4 or .40 or .400 are decimals having the same value, each being equal to $\frac{4}{10}$ or $\frac{2}{5}$; but when ciphers are placed on the left hand of a decimal, they decrease the value in a tenfold proportion. Thus .4 is $\frac{4}{10}$, or four tenths; but .04 is $\frac{4}{100}$, or four hundredths; and .004 is $\frac{4}{1000}$, or four thousandths. The figure next the separatrix is reckoned so many tenths; the next at the right, so many hundredths; the third is so many thousandths; and so on, as may be seen by the following table.

TABLE.

| | | | | | | | | | | | | |
|-----------|------------------------|--------------------|------------|-----------|-------|--------|---------|-------------|--------------|------------------|----------------------|-------------|
| Millions. | Hundreds of Thousands. | Tens of Thousands. | Thousands. | Hundreds. | Tens. | Units. | Tenths. | Hundredths. | Thousandths. | Ten Thousandths. | Hundred Thousandths. | Millionths. |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

From this Table it is evident, that in decimals, as well as in whole numbers, each figure takes its value by its distance from the place of units.

NOTE.—If there be one figure in the decimal, it is so many tenths; if there be two figures, they express so many hundredths; if there be three figures, they are so many thousandths, &c.

ADDITION OF DECIMALS.

RULE.

Place the numbers under each other, according to their value, and add as in whole numbers.

EXAMPLES.

1. Add 23.61 and 161.5 and 2.6789 and 61.111 and 27.0076 and 116.71 and 6151.7671 together.

In the work of this question, it will be perceived, that tenths are placed under tenths, hundredths under hundredths, &c.

$$\begin{array}{r}
 23.61 \\
 161.5 \\
 2.6789 \\
 61.111 \\
 27.0076 \\
 116.71 \\
 6151.7671 \\
 \hline
 6544.3846
 \end{array}$$

2. Add together the following numbers—81.61356, 6716.31, 413.1678956, 35.14671, 3.1671, 314.6.

Ans. 7564.0052656.

3. What is the sum of the following numbers—61.87, 1121.6116, 46.67, 165.13, 676.167895.

Ans. 2071.449495.

4. Add 7.61, 637.1, 6516.14, 67.1234, 6.1234, together.

Ans. 7234.0968.

5. Add 21.611, 6888.32, 3.6167, together.

Ans. 6913.5477.

6. Add seventy-three and twenty-nine hundredths, eighty-seven and forty-seven thousandths, three thousand and five and one hundred and six ten thousandths, twenty-eight and three hundredths, twenty-nine thousand and five thousandths together.

Ans. 32193.3826.

7. Add two hundred and nine thousand and forty-six millionths, ninety-eight thousand two hundred and seven and fifteen ten thousandths, fifteen and eight hundredths, and forty-nine ten thousandths, together.

Ans. 307222 086446.

8. What is the sum of twenty-three million and ten, and one thousand and five hundred thousandths, twenty-seven and nineteen millionths, seven and five tenths ?

Ans. 23001044.500069.

9. Add the following numbers: fifty-nine and fifty-nine thousandths, twenty-five thousand and twenty-five ten thousandths, five and five millionths, two hundred five and five hundredths.

Ans. 25269.111505.

10. What is the sum of the following numbers: twenty-five and seven millionths, one hundred forty-five, and six hundred forty-three thousandths, one hundred seventy-five and eighty-nine hundredths, seventeen and three hundred forty-eight hundred thousandths ?

Ans. 363.5364.87.

SUBTRACTION OF DECIMALS.

RULE.

Let the numbers be so placed, that the separatrix of the subtrahend be directly under that of the minuend, then subtract as in whole numbers.

EXAMPLES.

| 1. | 2. | 3. | 4. |
|---------|---------|-------|---------|
| 61.9634 | 39.3 | 5. | 6.1 |
| 9.182 | 1.6789 | 1.678 | 1.99999 |
| <hr/> | <hr/> | <hr/> | <hr/> |
| 52.7814 | 37.6211 | 3.322 | 4.10001 |

5. From 41.7 take 21.9767.

Ans. 19.7233.

6. From 29.167 take 19.66711.

Ans. 9.49989.

7. From 91.61 take 2.6671.

Ans. 88.9429.

8. From 96.71 take 96.709.

Ans. .001.

9. Take twenty-seven and twenty-eight thousandths from ninety-seven and seven tenths.

Ans. 70.672.

10. Take one hundred fifteen and seven hundredths from three hundred fifteen and twenty-seven ten thousandths.

Ans. 199.9327.

11. From twenty-nine million four thousand and five, take twenty-nine thousand, and three hundred forty-nine thousand two hundred, and twenty-four hundred thousandths.

Ans. 28625804.99976.

12. From one million take one millionth.

Ans. 999999.999999.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in whole numbers, and point off as many figures for decimals in the product, as there are decimals in the multiplicand and multiplier.

NOTE.—If after multiplying there be not so many figures in the product as in the multiplicand and multiplier, supply the defect by prefixing ciphers.

EXAMPLES.

1. Multiply 76.81

3.2

15362

23043

245.792

2. Multiply .1234

.0046

7404

4936

.00056764

3. Multiply 61.76 by .0071.

Ans. .438496.

4. Multiply .0716 by 1.326.

Ans. .0949416.

5. Multiply .61001 by .061.

Ans. .03721061.

6. Multiply 71.61 by 365.

Ans. 26137.65.

7. Multiply 1234 by 1234. Ans. 152.2756.
8. Multiply 6.711 by 6543. Ans. 4391.0073.
9. Multiply .0009 by .0009. Ans. .00000081.
10. Multiply forty-nine thousand by forty-nine thousandths. Ans. 2401.
11. What is the product of one thousand and twenty-five, multiplied by three hundred and twenty-seven ten thousandths? Ans. 33.5175.
12. What is the product of seventy-eight million two hundred and five thousand and two by fifty-three hundredths? Ans. 41448.65106.
13. Multiply one hundred and fifty-three thousandths by one hundred and twenty-nine millionths. Ans. .000019737.
14. What is the product of fifteen thousand, multiplied by fifteen thousandths? Ans. 225.
15. What will 26.7 yards of cloth cost, at \$5.75 a yard? Ans. \$153.52.5.
16. What will 14.75 bushels of wheat cost, at \$1.25 a bushel? Ans. \$18.43.7.5.
17. What will 375.6 pounds of sugar cost, at \$0.125 per pound? Ans. \$46.95.
18. What will 26.58 cords of wood cost, at \$5.625 a cord? Ans. \$149.51.2½.
19. What will 28.75 tons of potash cost, at \$125.78 per ton? Ans. \$3616.17.5.
20. What will 369 gallons of molasses cost, at \$0.375 a gallon? Ans. \$138.37.5.
21. What will 97.48 cwt. of hay cost, at \$1.125 per cwt.? Ans. \$109.66.5.
22. What will 63.5 bushels of corn be worth, at \$0.78 per bushel? Ans. \$49.53.

DIVISION OF DECIMALS.

RULE.

Divide as in whole numbers, and point off as many decimals in the quotient as the number of decimals in the dividend exceed those of the divisor; but if the number of those in the divisor exceed that of the dividend, supply the defect by annexing ciphers to the dividend. And if the number of decimals in the quotient and divisor together are not equal to the number in the dividend, supply the defect by prefixing ciphers to the quotient.

EXAMPLES.

1.

1.2) 1.728 (1.44

12

—
52

48

—
48

48

In this example we find the number of decimal places in the dividend to be three, and in the divisor to be one; therefore, as the number in the dividend exceeds that of the divisor by two, we point off two decimal places in the quotient.

2. Divide 680.516 by 2.43.

Ans. 321.2.

3. Divide 7. 25406 by 9.57.

Ans. .758.

4. Divide .21318 by .38.

Ans. .561.

5. Divide 7.2091365 by .5201.

Ans. 13.861+.

6. Divide 56.8554756 by 759.

Ans. 749.084.

7. Divide 30614.4 by .9567.

Ans. 32000.

8. Divide .306144 by 9567.

Ans. .000032.

9. Divide four thousand, three hundred, twenty-two and four thousand five hundred and seventy-three ten thousandths, by eight thousand and nine thousandths.

Ans. .5403+.

10. Divide thirty-six and six thousand nine hundred forty-seven ten thousandths, by five hundred and eighty-nine.

Ans. .0623.

11. Divide three hundred twenty-three thousand seven and sixty-five, by five millionths.

Ans. 64753000000.

REDUCTION OF DECIMALS.

CASE I.

To reduce a vulgar to its equivalent decimal.

RULE.—Divide the numerator by the denominator, annexing as many ciphers as are necessary, and the quotient will be the decimal required.

NOTE.—It is not necessary, that decimals should be carried to more than six places.

EXAMPLES.

1. Reduce $\frac{3}{8}$ to a decimal.

$$8 \overline{) 3000}$$

.375 Answer.

2. Reduce $\frac{5}{8}$ to a decimal.

Ans. .625.

3. Reduce $\frac{1}{2}$ to a decimal.

Ans. .5.

4. Reduce $\frac{3}{4}$, $\frac{2}{5}$, $\frac{5}{8}$, $\frac{1}{12}$, $\frac{3}{16}$, $\frac{1}{25}$ and $\frac{1}{3}$ to decimals.

Ans. .666+, .75, .833+, 91666+, .1875, .04—125.

5. Reduce $\frac{1}{17}$, $\frac{2}{27}$, $\frac{5}{37}$, $\frac{3}{47}$, $\frac{8}{11}$ and $\frac{1}{1234}$ to decimals.

Ans. .05881+, .07407+, .1351+, .00696+, .07207+, .000811+.

CASE II.

To reduce numbers of different denominations to their equivalent value.

RULE.—Write the given numbers perpendicularly under each other for dividends, proceeding orderly from the least to the greatest; opposite to each dividend, on the left hand, place such a number for a divisor, as will bring it to the next superior name, and draw a line between them. Begin at the highest, and write the quotient of each division, as decimal parts, on the right of the dividend next below it, and so on, till they are all divided; and the last quotient will be the decimal required.

EXAMPLES.

1. Reduce 15s. 19½d. to the decimal of a pound.

$$\begin{array}{r|l}
 4 & 3.00 \\
 12 & 9.75000 \\
 20 & 15.81250 \\
 \hline
 \end{array}$$

.790625

Ans. .790625.

2. Reduce 9s. to the fraction of a pound. Ans. .45.

3. Reduce 15cwt. 3qr. 14lb. to the decimal of a ton.

Ans. .14375.

4. Reduce 2qr. 21lb. 8oz. 12dr. to the decimal of a cwt.

Ans. .6923828125.

5. Reduce 1qr 3na. to the decimal of a yard. Ans. .4375.

6. Reduce 5 fur. 35rd. 2yd. 2ft. 9in. to the decimal of a mile.

Ans. .73603219+.

7. Reduce 3gal. 2qt. 1pt. of wine to the decimal of a hogs-head.

Ans. .575396+.

8. Reduce 1pt. to the decimal of a bushel. Ans. .015625.

9. Reduce 2R. 16p. to the decimal of an acre. Ans. .6.

CASE III.

To find the decimal of any number of shillings, pence, and farthings by *inspection*.

NOTE.—A demonstration of this case has been given, page 67.

RULE.—Write half of the greatest number of shillings for the first decimal figure, and if there be an odd shilling, annex a 5 to the half number of shillings, let the farthings in the given pence and farthings, occupy the second and third places, observing to increase their number by 1, if they exceed 12, and by 2, if they exceed 36.

EXAMPLES.

1. Find the decimal of 15s. 9¾d. by inspection.

7=½ of 14s.

05=for odd shilling.

39=farthings in 9¾d.

2=for excess of 36.

.791

2. Find the value of 13s. 6 $\frac{3}{4}$ d. by inspection. Ans. .678.
 3. Find the value of 19s. 8 $\frac{1}{4}$ d. by inspection. Ans. .984.
 4. Value the following sums by inspection, and find their total—19s. 11 $\frac{3}{4}$ d., 16s. 9 $\frac{1}{4}$ d., 1s. 11d., 3s. 0 $\frac{3}{4}$ d., 17s. 5 $\frac{1}{4}$ d., 13s. 4 $\frac{1}{4}$ d., 18s. 8 $\frac{1}{4}$ d., 19s. 11 $\frac{3}{4}$ d., 13s. 3 $\frac{1}{4}$ d., 16s. 0 $\frac{1}{4}$ d. 17s. 7 $\frac{3}{4}$ d.
 Ans. 7.91.

CASE IV.

To find the value of any given decimal in the terms of the integer.

RULE.—Multiply the given decimal by that number which it takes of the next denomination to make one of that greater, and cut off as many places for a *remainder* on the right, as there are places in the given decimal. Multiply the *remainder* by the next lower denomination, and cut off for a remainder as before, and so proceed, until the decimal is reduced to the denomination required; the several denominations, standing at the left hand, are the answers required.

EXAMPLES.

1. What is the value of .790625.£? Ans. 15s. 9 $\frac{3}{4}$ d.

$$\begin{array}{r}
 .790625 \\
 20 \\
 \hline
 15.812500 \\
 12 \\
 \hline
 9.750000 \\
 4 \\
 \hline
 3.000000
 \end{array}$$

2. What is the value of .625 of a shilling? Ans. 7 $\frac{1}{4}$ d.
 3. What is the value of .6725 of a cwt.? Ans. 2qr. 19lb. 5 $\frac{3}{5}$ oz.
 4. What is the value of .9375 of a yard? Ans. 3qr. 3na.
 5. What is the value of .7895 of a mile? Ans. 6p. 12rd. 10ft. 6 $\frac{1}{2}$ in.
 6. What is the value of .9378 of an acre? Ans. 3R. 30p. 13ft. 6 $\frac{22}{12}$ in.

7. Reduce .5615 of a hogshead of wine to its value in gallons, &c. Ans. 35gal. 1qt. 0pt. $3\frac{1}{2}\frac{3}{4}$ gi.
 8. Reduce .367 of a year to its value in days, &c. Ans. 134da. 1h. 7m. $19\frac{1}{2}$ sec.
-

MISCELLANEOUS EXAMPLES.

1. What is the value of 7cwt. 2qr. 18lb. of sugar, at \$11.75 per cwt. ? Ans. \$90.01.3+.
2. What cost 19 cwt. 3qr. 14lb. of iron, at \$9.25 per cwt. ? Ans. \$183.84.3 $\frac{1}{2}$.
3. What cost 39A. 2R. 15p. of land, at \$87.37.5 per acre ? Ans. \$3459.50.3+.
4. What would be the expense of making a turnpike 87m. 3fur. 15rds., at \$578.75 per mile ? Ans. \$50595.41.8 $\frac{1}{4}$.
5. What is the cost of a board 18ft. 9in. long, and 2ft. 3 $\frac{1}{2}$ in. wide, at \$05.3 per foot ? Ans. \$2.27.7+.
6. Goliath of Gath was 6 $\frac{1}{2}$ cubits high; what was his height in feet, the cubit being 1ft. 7.168in. ? Ans. 10ft. 4 592in.
7. If a man travel 4.316 miles in an hour; how long would he be in travelling from Bradford to Boston, the distance being 29 $\frac{1}{2}$ miles ? Ans. 6h. 50m. 6sec.
8. What is the cost of 5yd. 1qr. 2na. of broadcloth, at \$5.62 $\frac{1}{2}$ per yard ? Ans. \$30.23.4 $\frac{3}{4}$.
9. Bought 17 bags of hops, each weighing 4cwt. 3qr. 7lb., at \$5.87 $\frac{1}{2}$ per cwt.; what was the cost ? Ans. \$480.64.8.7 $\frac{1}{2}$.
10. Purchased a farm, containing 176A. 3R. 25rds., at \$75.37 $\frac{1}{2}$ per acre; what did it cost ? Ans. \$13334.30.8 $\frac{1}{2}$.
11. What cost 17625 feet of boards, at \$12.75 per thousand ? Ans. \$224.71.8 $\frac{1}{4}$.
12. How many square feet in a floor 19ft. 3in. long, and 15ft. 9in. wide ? Ans. 303ft. 27in.
13. How many square yards of paper will it take to cover a room 14ft. 6in. long, 12ft. 6in. wide, and 8ft. 9in. high ? Ans. 52 $\frac{1}{4}$ yd.

14. How many solid feet in a pile of wood 10ft. 7in. long, 4ft. wide, and 5ft. 10in. high? Ans. $246\frac{1}{2}$ ft.
15. How many garments, each containing 4yd. 2qr. 3na., can be made from 112yd. 2qr. of cloth? Ans. 24.
16. Bought 1gal. 2qt. 1pt. of wine for \$1.82; what would be the price of a hogshead? Ans. \$70.56.
17. Bought $125\frac{1}{2}$ yd. of lace for \$15.06; what was the price of one yard? Ans. \$0.12.
18. What cost 17cwt. 3qr. of wool, at \$35.75 per cwt.? Ans. \$634.56. $\frac{2}{3}$.
19. What cost 7hhd. 47gal. of wine, at \$87.25 per hhd.? Ans. \$675.84. $\frac{2}{3}$.
20. How many solid feet in a stick of timber 34ft. 9in. long, 1ft. 3in. wide, and 1ft. 6in. deep? Ans. 65.15625ft.
21. How many cwt. of coffee in $17\frac{3}{4}$ bags, each bag containing 2cwt. 1qr. 7lb.? Ans. 41cwt. 0qr. $5\frac{1}{4}$ lb.
22. If 18 yd. 1qr. of cloth cost \$36.50, what is the price of 1yd.? Ans. 2.00.
23. If \$477.72 be equally divided between 9 men, what will be each man's share? Ans. \$53.08.
24. A man bought a barrel of flour for \$5.37.5, 7gal. of molasses for \$1.78, 9gal. of vinegar for \$1.1875, 1gal. of wine for \$1.125, 14lb. of sugar for \$1.275, and 5lb. of tea, for \$2.625; what did the whole amount to? Ans. \$13.36. $\frac{7}{8}$.
25. A man purchased 3 loads of hay; the first contained $2\frac{3}{8}$ tons, the second $3\frac{7}{8}$ tons, and the third $1\frac{1}{16}$ tons; what was the value of the whole, at \$17.625 a ton? Ans. \$128.82. $\frac{21}{16}$.
26. At \$13.625 per cwt., what cost 3cwt. 2qr. 7lb. of sugar? Ans. 48.53.9. $\frac{1}{16}$.
27. At \$125.75 per acre, what cost 37A. 3R. 35rds.? Ans. \$477457.0. $\frac{5}{16}$.
28. At \$11.25 per cwt., what cost 17cwt. 2qr. 21lb. of rice? Ans. \$198.98.4. $\frac{3}{8}$.
29. What cost $7\frac{3}{4}$ bales of cotton, each weighing 3.37cwt., at \$9.37. $\frac{1}{2}$ per cwt.? Ans. \$244.85.1. $\frac{3}{16}$.
30. What cost 7hhd. 49gal. of wine, at \$97.625 per hhd.? Ans. \$759 30.5. $\frac{3}{8}$.
31. What cost 7yd. 3qr. 3na. of cloth, at \$4.75 per yard? Ans. \$37.70.3. $\frac{1}{4}$.
32. What cost 27T. 15cwt. 1qr. $3\frac{1}{2}$ lb. of hemp, at \$183.62 per ton? Ans. \$5098.03.7. $\frac{5}{32}$.
33. What is the cost of constructing a rail-road 17m. 3fur. 15rd., at \$1725.87.5 per mile? Ans. \$30067.97.8. $\frac{1}{2}$.

EXCHANGE OF CURRENCIES.

Previous to the year 1776, all accounts in this country were kept in pounds, shillings, pence, and farthings; but owing to the depreciation of the currency, a dollar was estimated differently in different countries.

| | |
|--|---------|
| In New England, Virginia, Kentucky, Tennessee, and Ohio, the dollar is valued at | 6s. 0d. |
| New York, North Carolina, and New Jersey, | 8s. 0d. |
| Pennsylvania, Delaware, and Maryland, | 7s. 6d. |
| South Carolina and Georgia, | 4s. 8d. |
| Canada and Nova Scotia, | 5s. 0d. |
| England and Newfoundland (sterling), | 4s. 6d. |

In order, therefore, to change any of the above currencies to federal money, the shillings, pence and farthings, if there be any, must first be reduced to decimals of a pound, and annexed to the pounds. We then adopt this general

RULE.—Divide the pounds by the value of a dollar in the given currency, *expressed by a fraction of a pound*; that is, to change the old New England currency to federal money, divide by $\frac{3}{10}$; because 6 shillings is $\frac{3}{10}$ of a pound.

To change the old currency of New York, &c., to federal money, divide by $\frac{4}{10}$; because 8 shillings is $\frac{4}{10}$ of a pound.

To change the old currency of Pennsylvania, &c., to federal money, divide by $\frac{3}{8}$; because 7 shillings and 6 pence is $\frac{3}{8}$ of a pound.

To change the old currency of South Carolina and Georgia to federal money, divide by $\frac{7}{10}$ of a pound; because 4 shillings and 8 pence is $\frac{7}{10}$ of a pound.

To change Canada and Nova Scotia currency to federal money, divide by $\frac{1}{4}$; because 5 shillings is $\frac{1}{4}$ of a pound.

To change English (sterling) money to federal money, divide by $\frac{9}{40}$; because 4 shillings and 6 pence is $\frac{9}{40}$ of a pound.

To change sterling money to lawful money, add $\frac{1}{4}$ to the sterling, and the sum will be the lawful; because 4 shillings and 6 pence sterling is 6 shillings lawful; and, for the same reason, take $\frac{1}{4}$ from the lawful, and the remainder will be sterling.

To reduce federal money to any of the above currencies, the federal money must be *multiplied* by the above fractions.

EXAMPLES.

1. Change 18£ 5s. 6d. of the old New England currency to federal money.

$$\$18.225 \div \frac{3}{10} = \$60.75 \text{ Answer.}$$

In this example, we reduce the 4 shillings and 6 pence to a decimal of a pound, which we find to be .225. This decimal we annex to the pounds, and multiply the 18.225£ by 10, and divide by 3, and it produces the answer \$60.75. The reason for this process has already been shown.

2. Change \$60.75 to the old currency of New England.

$$\$60.75 \times \frac{3}{10} = 18.225 = 18£ \text{ 5s. 6d.} = \text{Answer.}$$

The decimal .225 is reduced to shillings and pence by Case 4 of decimal fractions.

3. Change 78£ 7s. 6d. of the old currency of New England to federal money.

$$\text{Ans. } \$261.25.$$

4. Change \$261.25 to the old currency of New England.

$$\text{Ans. } 78£ \text{ 7s. 6d.}$$

5. Change £46 16s. 6d. of the old currency of New York to federal money.

$$\text{Ans. } \$261.25.$$

6. Change \$261.25 to the old currency of New York.

$$\text{Ans. } 46£ \text{ 16s. 6d.}$$

7. Change 387£ of the old currency of New Jersey and Pennsylvania to federal money.

$$\text{Ans. } \$1032.$$

8. Change \$1032 to the old currency of New Jersey and Pennsylvania.

$$\text{Ans. } 387£.$$

9. Change 12£ 12s. of the old currency of South Carolina and Georgia to federal money.

$$\text{Ans. } \$54.$$

10. Change \$54 to the old currency of South Carolina and Georgia.

$$\text{Ans. } 12£ \text{ 12s.}$$

11. Change 128£ 18s. 6d. of Canada and Nova Scotia to federal money.

$$\text{Ans. } \$515.70.$$

12. Change \$515.70 to Canada and Nova Scotia currency.

$$\text{Ans. } 128£ \text{ 18s. 6d.}$$

13. Change 162£ 18s. English money (sterling) to federal money.

$$\text{Ans. } \$724.$$

14. Change \$724 to sterling money.

$$\text{Ans. } 162£ \text{ 18s.}$$

15. Change 347£ sterling to lawful money.

$$\text{Ans. } 462£ \text{ 13s. 4d.}$$

16. Change 462£ 13s. 4d. lawful to sterling.

$$\text{Ans. } 347£.$$

CIRCULATING DECIMALS.*

Those decimals that are produced from Vulgar Fractions, whose denominators do not measure their numerators, and are distinguished by the continual repetition of the same figure or figures, are called *infinite decimals*.

The circulating figures, that is, those that continually repeat, are called *repetends*; and, if the same figure only repeats, it is called a *single repetend*; as $.1111$ or $.5555$, and is expressed by writing the circulating figure with a point over it; thus, $.1111$, and is denoted by $.1$, and $.5555$ by $.5$.

If the *same* figures circulate alternately, it is called a *compound repetend*; as $.475475475$, and is distinguished by putting a point over the first and last repeating figures; thus, $.475475475$ is written $.4\dot{7}5$. Sometimes other figures arise before those which circulate; it is then called a *mixed repetend*; as $.124\dot{6}$ or $.178\dot{3}5$.

Similar repetends begin at the same place; as $.3$ and $\dot{6}$; or 5 , $1\dot{2}3$ and $3.4\dot{7}8$.

Dissimilar repetends begin at different places; as $.98\dot{6}$ and $.46\dot{2}5$.

Conterminous repetends end at the same place; as $.63\dot{1}$ and $.46\dot{5}$.

Similar and conterminous repetends begin and end at the same place; as $.172\dot{8}$ and $.498\dot{7}$.

REDUCTION OF CIRCULATING DECIMALS.

CASE I.

To reduce a simple repetend to its equivalent vulgar fraction.

*NOTE.—As Circulating Decimals are not so much of a practical nature as many other rules, and as they are somewhat difficult in their operation, the student can omit them until he revises arithmetic.

RULE.—Make the given decimal the numerator, and let the denominator be a number consisting of as many nines, as there are recurring places in the repetend.

If there be integral figures in the circulate, as many ciphers must be annexed to the numerator, as the highest place of the repetend is distant from the decimal point.

[NOTE.—If unity with ciphers annexed to it be divided by 9 ad infinitum, the quotient will be 1 continually; that is, if $\frac{1}{9}$ be reduced to a decimal, it will produce the circulate $.1$; and since $.1$ is the decimal, equivalent to $\frac{1}{9}$, $.2$ will be equal to $\frac{2}{9}$, $.3$ to $\frac{3}{9}$, and so on, till $.9$ is equal to $\frac{9}{9}$ or 1. Therefore every single repetend is equal to a vulgar fraction, whose numerator is the repeating figure and denominator 9. Again, $\frac{1}{99}$ or $\frac{1}{99}$, being reduced to decimals, makes $.01010101$ and $.001001001$ ad infinitum. $= .0\bar{1}$ and $.00\bar{1}$, that is, $\frac{1}{99} = .0\bar{1}$, and $\frac{1}{999} = .00\bar{1}$; consequently $\frac{2}{99} = .0\bar{2}$ and $\frac{2}{999} = .00\bar{2}$; and the same will hold universally.]

EXAMPLES.

1. Required the least vulgar fraction equal to $.6$ and $.1\bar{2}3$.

$$.6 = \frac{6}{10} = \frac{3}{5} \text{ Answer.} \quad .1\bar{2}3 = \frac{123}{999} = \frac{41}{333} \text{ Answer.}$$

2. Reduce $.3$ to its equivalent vulgar fraction. Ans. $\frac{1}{3}$.

3. Reduce $.6\bar{2}$ to its equivalent vulgar fraction. Ans. $1\frac{2}{3}$.

4. Reduce $.76923\bar{0}$ to its equivalent vulgar fraction. Ans. $1\frac{1}{3}$.

CASE II.

To reduce a mixed repetend to its equivalent vulgar fraction.

RULE.—To as many nines as there are figures in the repetend, annex as many ciphers as there are finite places for a denominator; multiply the nines in the denominator by the finite part, and add the repeating decimal to the product for the numerator. If the repetend begins in some integral place, the finite value of the circulating must be added to the finite part.

NOTE.—For a mixed circulate, consider it as divisible into its finite and circulating parts, and the same principle will be seen

to run through them also; thus the mixed circulate $.1\dot{6}$ is divisible into the finite decimal $.1$ and the repetend $.0\dot{6}$; but $1 = \frac{1}{10}$ and $0\dot{6}$ would be $\frac{6}{90}$, provided the circulation began immediately after the place of units, but as it begins after the place of tens, it is $\frac{6}{90}$ of $\frac{1}{10} = \frac{6}{900}$. Therefore $.1\dot{6}$ is $= \frac{1}{10} + \frac{6}{900} = \frac{90}{900} + \frac{6}{900} = \frac{96}{900} = \frac{8}{75}$. Q. E. D.

EXAMPLES.

1. What vulgar fraction is equivalent to $.13\dot{8}$?

$9 \times 13 + 8 = 125 = \text{numerator}$, and $900 = \text{denominator}$.

Therefore $.13\dot{8} = \frac{125}{900} = \frac{5}{36}$ Answer.

2. What is the least vulgar fraction equivalent to $.5\dot{3}$?

Ans. $\frac{5}{15}$.

3. What is the least vulgar fraction equivalent to $.59\dot{2}\dot{5}$?

Ans. $\frac{1}{2}$.

4. What is the least vulgar fraction equivalent to $.008\dot{4}9713\dot{3}$?

Ans. $\frac{8}{9788}$.

5. What is the finite number equivalent to $31.6\dot{2}$?

Ans. $31\frac{2}{3}$.

CASE III.

To make any number of dissimilar repetends, similar and conterminous.

RULE.—Change them into other repetends, which shall consist of as many figures, as the least common multiple of the several number of places, found in all the repetends, contains units.

[**NOTE.**—Any given repetend whatever, whether single, compound, pure, or mixed, may be transformed into another repetend, that shall consist of an equal or greater number of figures at pleasure; thus, $.4$ may be changed into $.4\dot{4}$ or $4\dot{4}\dot{4}$, and $5\dot{7} = 575\dot{7} = 575\dot{7} = 57\dot{5}$, and so on, which is sufficiently evident without further demonstration.]

EXAMPLES.

1. Dissimilar made similar and conterminous.

| | |
|--------|-------------|
| 9.167 | 9.16767676 |
| 14.6 | 14.60000000 |
| 3.165 | 3.16555555 |
| 12.432 | 12.43243243 |
| 8.181 | 8.18181818 |
| 1.307 | 1.30730730 |

2. Make 3.671, 1.0071, 8.52 and 7.616325 similar and conterminous.

3. Make 1.52, 8.7156, 3.567 and 1.378 similar and conterminous.

4. Make .0007, .141414 and 887.1 similar and conterminous.

CASE IV.

To find whether the decimal fraction, equal to a given vulgar fraction, be finite or infinite, and of how many places the repetend will consist.

RULE.—Reduce the given fraction to its least terms, and divide the denominator by 2, 5 or 10, as often as possible. If the whole denominator vanish in dividing by 2, 5 or 10, the decimal will be finite, and will consist of so many places, as you perform division. If it do not vanish, divide 9999, &c., by the result, till nothing remain, and the number of nines used will show the number of places in the repetend; which will begin after so many places of figures, as there are tens, twos or fives used in dividing.

[NOTE.—In dividing 1.0000, &c. by any prime number whatever except 2 or 5, the quotient will begin to repeat as soon as the remainder is 1. And since 9999, &c. is less than 10000, &c. by 1, therefore 9999, &c., divided by any number whatever, will leave an 0 for a remainder, when the repeating figures are at their period. Now whatever number of repeating figures we have, when the dividend is 1, there will be ex-

actly the same number, when the dividend is any other number whatever. For the product of any circulating number, by any other given number, will consist of the same number of repeating figures as before. Thus, let 378137813781, &c. be a circulate, whose repeating part is 3781. Now every repetend (3781) being equally multiplied, must produce the same product. For these products will consist of more places, yet the overplus in each being alike, will be carried to the next, by which means, each product will be equally increased, and consequently every four places will continue alike. And the same will hold for any other number whatever. Hence it appears, that the dividend may be altered at pleasure, and the number of places in the repetend will be still the same; thus, $\frac{1}{11} = .\dot{9}0$, and $\frac{1}{11} = .2\dot{7}$, where the number of places in each are alike, and the same will be true in all cases.]

EXAMPLES.

1. Required to find whether the decimal equal to $\frac{219}{1120}$ be finite or infinite; and, if infinite, of how many places the repetend will consist.

$\frac{219}{1120} = \frac{219}{2)112} = \frac{109}{56} = \frac{109}{2)28} = \frac{54}{14} = \frac{27}{7} = 3\frac{6}{7}$; therefore, because the denominator vanishes in dividing, the decimal is finite, and consists of four places; thus, $16)3.9999$.

2. Required to find whether the decimal equal to $\frac{475}{2800}$ be finite or infinite, and, if infinite, of how many places that repetend will consist.

$\frac{475}{2800} = \frac{19}{112} = \frac{19}{2)112} = \frac{9}{56} = \frac{9}{2)28} = \frac{4}{14} = \frac{2}{7}$. Thus, $7)999999$; therefore, because the denominator 112 did not vanish in dividing by 2, the decimal is infinite, and, as six nines were used, the circulate consists of six places, beginning at the fifth place, because four twos were used in dividing.

3. Let $\frac{1}{11}$ be the fraction proposed.

4. Let $\frac{107}{253}$ be the fraction proposed.

ADDITION OF CIRCULATING DECIMALS.

RULE.

Make the repetends similar and conterminous, and find their sum, as in common addition. Divide this sum by as many nines as there are places in the repetend, and the remainder is the repetend of the sum, which must be set under the figures added, with ciphers on the left, when it has not so many places as the repetends. Carry the quotient of this division to the next column, and proceed with the rest as with finite decimals.

EXAMPLES.

1. Let $3.5 + 7.65\dot{1} + 1.76\dot{5} + 6.17\dot{3} + 51.7 + 3.7 + 27.63\dot{1}$ and $1.00\dot{3}$ be added together.

| Dissimilar. | Similar and conterminous. |
|-------------|---------------------------|
| 3.5 | 3.5555555 |
| 7.651 | 7.6516516 |
| 1.765 | 1.7657657 |
| 6.173 | 6.1737373 |
| 51.7 | 51.7777777 |
| 3.7 | 3.7000000 |
| 27.631 | 27.6316316 |
| 1.003 | 1.0030030 |
| | <hr/> |
| | 103.2591227 |

2. Add $27.5\dot{6} + 5.63\dot{2} + 6.7 + 16.35\dot{6} + 7\dot{1}$ and $6.123\dot{4}$ together.
 Ans. 63.1990688863888 .

3. Add $2.76\dot{5} + 7.1667\dot{4} + 3.67\dot{1} + 7$ and $172\dot{8}$ together.
 Ans. 14.554365436 .

4. Add $5.1634\dot{5} + 8.638\dot{1} + 3.7\dot{5}$ together.
 Ans. $17.5591912084737409030\dot{2}$.

SUBTRACTION OF CIRCULATING DECIMALS.

RULE.

Make the repetends similar and conterminous, and subtract as usual; observing, that if the repetend of the subtrahend be greater than the repetend of the minuend, then the remainder on the right must be less by unity, than it would be, if the expressions were finite.

EXAMPLES.

1. From $87.16\dot{4}\dot{5}$ take $19.47\dot{9}16\dot{7}$.

$$87.16\dot{4}\dot{5} = 87.16454\dot{5}$$

$$19.47\dot{9}16\dot{7} = 19.47916\dot{7}$$

$67.68\dot{5}37\dot{7}$ Answer.

2. From $7.\dot{1}$ take $5.\dot{0}\dot{2}$. Ans. $2.\dot{0}\dot{8}$.
 3. From $31\dot{5}.8\dot{7}$ take $78.\dot{0}37\dot{8}$. Ans. $237.\dot{8}3907209549\dot{7}$.
 4. Subtract $\frac{1}{4}$ from $\frac{2}{3}$. Ans. $0.7936\dot{5}$.

MULTIPLICATION OF CIRCULATING DECIMALS.

RULE.

Turn both the terms into their equivalent vulgar fractions, and find the product of those fractions as usual. Then change the vulgar fraction, expressing the product, into an equivalent decimal, and it will be the product required. But, if the mul-

tiplicand *only* has a repetend, multiply as in whole numbers, and add to the right hand place of the product as many units as there are tens in the product of the left hand place of the repetend. The product will then contain a repetend, whose places are equal to those in the multiplicand.

EXAMPLES.

1. Multiply $.3\dot{6}$ by $.2\dot{5}$.

$$.3\dot{6} = \frac{36}{100} = \frac{4}{11}, \quad .2\dot{5} = \frac{25}{100} = \frac{5}{40} = \frac{23}{90}.$$

$$\frac{4}{11} \times \frac{23}{90} = \frac{92}{990} = .09\dot{2}9 = \text{Answer}.$$

2. Multiply 582.347 by .08.

Second method.

$$582.347 \times .08 = 46.5877\dot{6} = \text{Answer}.$$

3. Multiply 87.32586 by 4.37. Ans. 381.6140336.

4. Multiply 3.145 by 4.297. Ans. 13.5169533.

5. What is the value of $.2\dot{8}571\dot{4}$ of a guinea?

Ans. 8s.

6. What is the value of $.46160714285\dot{6}$ of a ton?

Ans. 9cwt. 0qr. 26lb.

7. What is the value of $.2\dot{8}493150\dot{6}$ of a year?

Ans. 104da.

DIVISION OF CIRCULATING DECIMALS.

RULE.

Change both the divisor and the dividend into their equivalent vulgar fractions, and find their quotient as usual. Change the vulgar fraction, expressing the quotient, into its equivalent decimal, and it will be the quotient required.

EXAMPLES.

1. Divide
- $.54$
- by
- 15
- .

$$.54 = \frac{54}{100} = \frac{6}{11} \text{ and } .15 = \frac{15}{100} = \frac{3}{20} = \frac{14}{90} \frac{7}{5}.$$

$$\frac{6}{11} \div \frac{3}{20} = \frac{6}{11} \times \frac{20}{3} = \frac{270}{77} = 3\frac{33}{77} = 3.506493 \text{ Answer.}$$

2. Divide
- $345.\dot{8}$
- by
- $.6$
- .

Ans. $518.\dot{8}$.

3. Divide
- $234.\dot{6}$
- by
- $\dot{7}$
- .

Ans. $310.\dot{7}1428\dot{5}$.

4. Divide
- $.3\dot{6}$
- by
- $.2\dot{5}$
- .

Ans. $1.422924901185770750988\dot{1}$.

MISCELLANEOUS QUESTIONS.

TO BE PERFORMED BY ANALYSIS.

If a man travel 48 miles in 12 hours; how far will he travel in 17 hours? Ans. 68m.

[The following is the most obvious solution of this question. If he travel 48 miles in 12 hours, in 1 hour he will travel $\frac{1}{12}$ of 48 miles, which is 4 miles. Then if he travel 4 miles in 1 hour, he will in 17 hours travel 17 times as far, which is 68 miles, the answer.]

2. If 72 pounds of beef cost \$6.48, what will 1 pound cost? what will 675 pounds cost? Ans. \$60.75.

3. If $\frac{1}{8}$ of a dollar buy 1 pound of sugar, how much may be bought for \$1? how much for \$29 $\frac{7}{8}$? Ans. 239lb.

4. If a hogshead of wine cost \$73.50, what is the value of 1 gallon? what cost 17 hhd. 45 gallons? Ans. \$1302.00.

5. Bought 11 bushels of rye for \$9.00; what cost 25 bushels? Ans. \$20.45 $\frac{5}{11}$.

6. If a crew of 15 hands consume in 3 months 1620 pounds of beef, how much would be sufficient for 27 hands for the same time? Ans. 2916lb.

7. Bought 9 yards of flannel for \$7.00; what would be the value of $37\frac{1}{9}$ of a yard? Ans. \$29.31 $\frac{1}{9}$.

8. If a certain field will pasture 8 horses 9 weeks, how long will it pasture 23 horses? Ans. $25\frac{1}{3}$ w.

9. If $7\frac{3}{12}$ dozen of hats cost \$318.50, what will $19\frac{1}{12}$ dozen cost? Ans. \$874.94 $\frac{5}{8}$.

10. If 1 ton of hay cost \$25.00, what will 17 tons 13 cwt. 19 pounds cost? Ans. \$441.78 $\frac{1}{2}$.

11. What part of $9\frac{1}{4}$ is 25? Ans. $2\frac{2}{3}$.

12. What part of 25 is $9\frac{1}{4}$? Ans. $\frac{38}{100}$.

13. If \$25 will pay for $7\frac{3}{8}$ yards of broadcloth, what would be the price of 97 yards? Ans. 328.81 $\frac{1}{2}$.

14. If \$47.25 will pay for the keeping of 7 horses 2 months, what would it cost to keep 43 horses for the same time? Ans. \$290.25.

15. If $7\frac{1}{2}$ yards of cloth a yard wide is sufficient to make a cloak, how many yards would it take if the cloth was $1\frac{1}{4}$ yards wide? Ans. 4 $\frac{1}{2}$ yd.

16. If a barrel of beer will last 10 men a week, how long would it last one man? how long 37 men? Ans. $13\frac{3}{7}$ da.

17. If 5 calves are worth 9 sheep, how many calves will purchase 108 sheep? Ans. 60 calves.

18. If 11 yards of cotton 3 quarters wide are sufficient to line a garment, how many yards would it require that were 5 quarters wide? Ans. 6 $\frac{3}{4}$ yd.

19. If 7 pair of shoes will purchase 2 pair of boots, how many pair of shoes would it take to buy 18 pair of boots? Ans. 63 pair.

20. If 4 gallons of vinegar be worth 7 gallons of cider, what quantity of vinegar would it take to buy 47 gallons of cider? Ans. 26 $\frac{2}{3}$ gal.

21. If a man travel 377 miles in 15 days, how far would he travel in 1 day; how far in 100 days? Ans. 2513 $\frac{1}{3}$ m.

22. If 12 men can dig a ditch 50 feet long, and 4 feet wide, 3 feet deep, in 30 days, how long would it take one man? how long 47 men? Ans. 7 $\frac{1}{4}$ da.

23. If 5 barrels of flour cost \$25.75, what will 39 barrels cost? Ans. \$200.85.

24. Bought 17 acres of land for \$791.01; what would 98 acres, 3 rods, and 14 perches cost? Ans. \$4595.86 $\frac{1}{2}$.

25. Bought $97\frac{3}{8}$ yards of cloth for \$275.20; what is the price of 7 yards? Ans. \$19.78 $\frac{1}{2}$.

26. If a pole 7 feet long cast a shadow of 5 feet, how high is that steeple, whose shadow is 97 feet? Ans. 135 $\frac{1}{2}$ ft.

27. Gave $3\frac{3}{4}$ cwt. of sugar, at \$9 for $\frac{1}{11}$ of an acre of land; how much sugar would it have required to purchase an acre?

Ans. $5\frac{3}{4}$ cwt.

28. If a vessel sail $47\frac{3}{4}$ miles in $3\frac{3}{4}$ hours, how far would it sail in one week?

Ans. $2441\frac{1}{2}$ m.

29. James can mow a field in 7 days, by laboring 10 hours a day; how many days would it take him to perform the work by laboring 12 hours a day?

Ans. $5\frac{5}{6}$ d.

30. If $\frac{1}{11}$ of a lot of land is worth \$42.12, what is the value of $\frac{1}{3}$ of it?

Ans. \$29.41 $\frac{1}{3}$.

31. If a man can earn \$10.27 in $\frac{1}{4}$ of a week, how much would he earn in a month?

Ans. \$71.89.

32. If 18 men can reap 72 acres in 5 days, how long would it take 6 men to perform the labor?

Ans. 15 days.

33. If 19 gallons of wine can be bought for \$25, how many gallons will \$71.25 buy?

Ans. 54.15.

34. If a penny loaf weighs 8 ounces, when wheat is \$1 a bushel, what should it weigh, when wheat is sold for \$1.25 a bushel?

Ans. $6\frac{1}{2}$ oz.

35. If a basket, which contains $1\frac{1}{2}$ bushels, must be filled with apples 7 times to make one barrel of cider, how many barrels may be made by its being filled 126 times?

Ans. 16 bbls.

36. If a cloak can be made of $4\frac{1}{2}$ yards of cloth, that is $1\frac{3}{4}$ yards wide, how many yards would it take, of cloth that is $\frac{1}{4}$ of a yard wide?

Ans. 6 yds. 1 qr. $3\frac{3}{4}$ na.

37. If a box 4 feet long, 2 feet wide, $1\frac{1}{2}$ feet high, contains 300 pounds of sugar, how much will a box that is 8 feet long, 4 feet wide, and 3 feet high contain?

Ans. 2400 lbs.

38. How much in length, that is $12\frac{1}{4}$ rods in breadth, will make an acre?

Ans. $12\frac{3}{4}$ rd.

39. Sound, uninterrupted, moves 1142 feet a second; how long, after a cannon's being discharged at Boston, is the time before it is heard at Bradford, the nearest distance being $25\frac{1}{2}$ miles?

Ans. 2 min.

40. Bought $\frac{1}{11}$ of a ton of potash, and sold $\frac{1}{11}$ of it for \$46.70; what was the value of a ton?

Ans. \$93.40.

41. If $\frac{1}{11}$ of a lot of land be worth \$97, what would the whole lot be worth?

Ans. \$266.75.

42. If 19 pounds of salmon be worth 50 pounds of beef, how much salmon would buy 77 pounds of beef?

Ans. $29\frac{1}{3}$ lbs.

43. What part of $17\frac{3}{11}$ is $4\frac{1}{11}$? Ans. $\frac{204}{1087}$.
 44. What part of 11 shillings 3 pence is 15s. ? Ans. $\frac{4}{5}$.
 45. What part of $7\frac{1}{4}$ yards is $3\frac{3}{8}$ ells English ? Ans. $\frac{1}{2}$.

SIMPLE INTEREST.

Interest is the compensation, which the *borrower* of money makes to the *lender*.

Principal, is the sum lent.

Amount, is the interest added to the principal.

Per cent., a contraction of per centum, is the rate established by law; or that which is agreed on by the parties, and is so much for a hundred dollars for one year.

GENERAL RULE.*

Multiply the principal by the rate per cent. and divide by 100, and the quotient is the answer for one year; or, multiply by the per cent. and cut off two figures from the right hand, and those at the left will be the interest in dollars, and those at the right will be decimals of a dollar.

SECOND METHOD.—Let the per cent. be considered a decimal of a hundred dollars, and multiply the principal by it. Thus, .06 is the decimal for 6 per cent. and .08 is the decimal for 8 per cent.

NOTE.—When no particular per cent. is named, 6 per cent. is to be understood; as it is the legal interest in the New-England States generally. In New-York, the legal interest is 7 per cent.

* This rule is obvious, from the fact, that the *rate per cent.* is such a part of *every hundred*. Thus, 6 per cent. is $\frac{6}{100}$ of the *principal*.

EXAMPLES.

1. What is the interest of \$144 for one year ?

First method.

$$\begin{array}{r} 144 \\ 6 \\ \hline 100)864 \end{array}$$

\$8.64 Answer.

Second method.

$$\begin{array}{r} 144 \\ .06 \\ \hline \end{array}$$

\$8.64 Answer.

2. What is the interest of \$78 for 1 year ?
Ans. \$4.68.
3. What is the interest of \$675 for 1 year ?
Ans. \$40.50.
4. What is the interest of \$1728 for 1 year ?
Ans. \$103.68.
5. What is the interest of \$19.64 for 2 years ?
Ans. \$2.35.6.
6. What is the interest of \$896.28 for 3 years ?
Ans. \$161.33.
7. What is the interest of \$349.25 for 10 years ?
Ans. \$209.55.
8. What is the interest of \$3967.87 for 2 years ?
Ans. \$476.14.4.
9. What is the interest of \$123.45 for 6 years ?
Ans. \$44.42.2.
10. What is the interest of \$89.25 for 50 years ?
Ans. \$267.75.
11. What is the interest of \$17.25 for 7 years ?
Ans. \$7.24.5.
12. What is the amount of \$29.19 for 9 years ?
Ans. \$15.76.2.
13. What is the amount of \$617.56 for 25 years ?
Ans. \$926.34.
14. What is the amount of \$31.75 for 100 years ?
Ans. \$187.50.
15. What is the amount of \$76.47 for 7 years ?
Ans. \$32.11.7.
16. What is the amount of \$716.57 for 4 years ?
Ans. \$171.97.6.

17. What is the amount of \$178.56.5 for 30 years ?
 Ans. \$321.41.7.
 18. What is the interest of \$97.06 for 9 years ?
 Ans. \$52.51.2.
 19. What is the interest of \$0.75 for 75 years ?
 Ans. \$3.37.5.

CASE I.

To find the interest for months, at 6 per cent.

RULE.*—Multiply the principal by half the number of months, and proceed as in the general rule; or, let half the number of months be considered as a decimal.

EXAMPLES.

1. What is the interest of \$368 for 8 months ?

$$\begin{array}{r} 368 \\ .04 = \text{half the months.} \\ \hline \end{array}$$

 \$14.72 = Answer.
 2. What is the interest of \$637 for 10 months ?
 Ans. \$31.85.
 3. What is the interest of \$1671.32 for 14 months ?
 Ans. \$116.99.
 4. What is the interest of \$891.24 for 9 months ?
 Ans. \$40.10.
 5. What is the interest of \$819.75 for 11 months ?
 Ans. \$45.08.6.
 6. What is the interest of \$3671.25 for 13 months ?
 Ans. \$238.63.
 7. What is the interest of \$61.18 for 15 months ?
 Ans. \$4.58.
 8. What is the interest of \$3181.29 for 18 months ?
 Ans. \$286.31.
 9. What is the interest of \$11.39 for 19 months ?
 Ans. \$1.08.
 10. What is the interest of \$9.98 for 23 months ?
 Ans. \$1.14.

* It is obvious, that if the rate per cent. were 12, it would be 1 per cent. a month. If, therefore, it be 6 per cent. it will be half per cent. a month; that is, half the months will be the per cent.

3. What is the interest of \$396.15 for 13 months and 9 days ?
Ans. \$26.34.3.
4. What is the interest of \$16.75 for 7 months and 17 days, at 7 per cent. ?
Ans. \$0.73.9.
5. What is the interest of \$976.18 for 29 months and 23 days, at 9 per cent. ?
Ans. \$21.793.2.
6. What is the interest of \$36.18 for 3 months and 7 days ?
Ans. \$0.58.4.
7. What is the interest of \$51.17 for 9 months and 29 days, at 4 per cent. ?
Ans. \$1.69.9.
8. What is the interest of \$365.19 for 33 months and 4 days, at 2 per cent. ?
Ans. \$20.16.6.
9. What is the interest of \$125.75 for 5 months and 4 days ?
Ans. \$3.22.7.
10. What is the interest of \$35.49 for 1 month and 2 days, at $7\frac{1}{2}$ per cent. ?
Ans. \$0.23.6.
11. What is the interest of \$112.50 for 3 months and 1 day, at $9\frac{1}{2}$ per cent. ?
Ans. \$2.70.1.
12. What is the interest of \$97.15 for 35 months and 27 days ?
Ans. \$17.43.8.
13. What is the interest of \$47.15 for 1 month and 19 days, at $13\frac{1}{2}$ per cent. ?
Ans. \$0.86.6.
14. What is the interest of \$678.75 for 87 months and 20 days ?
Ans. \$297.51.8.
15. What is the interest of \$86 for 99 months and 19 days, at 25 per cent. ?
Ans. \$179.10.6.
16. What is the interest of \$33.35.8 for 15 months and 17 days ?
Ans. \$2.59.6.
17. What is the interest of \$144 for 5 days ?
Ans. \$0.01.2.

CASE III.

When the interest is required on any sum, from a certain day of the month in a year, to a particular day of a month in the same, or in another year.

RULE.—Find the time, by placing the latest date in an upper line, and the earliest date under it. Let the year be placed first ; the number of months, that have elapsed since the year commenced, at its right hand, and the day of the month next ; then subtract the earlier from the latest date, and the remainder is the time for which the interest is required. Then proceed

as in the last rule. Or, the months may be considered as fractional parts of a year, and the days as fractional parts of a month.

EXAMPLES.

1. What is the interest of \$84.97, from Sept. 25, 1833, to March 8, 1835?

| | | |
|-------|----|----|
| Yrs. | m. | d. |
| 1835 | 2 | 8 |
| 1833 | 8 | 25 |
| <hr/> | | |
| 1 | 5 | 13 |

First method.

| |
|--------------------|
| 84.97 |
| .087 $\frac{1}{2}$ |
| <hr/> |
| 59479 |
| 67976 |
| 1416 |
| <hr/> |

7.40.6.55 Ans. \$7.40.6.

Second method.

| |
|---------------------------------|
| 84.97 |
| .06 |
| <hr/> |
| 5.0982 |
| 4 m'ths, $\frac{1}{3}$ = 1.6994 |
| 1 month, $\frac{1}{4}$ = .4248 |
| 10 days, $\frac{1}{5}$ = .1416 |
| 2 days, $\frac{1}{5}$ = 283 |
| 1 day, $\frac{1}{5}$ = 141 |

It is evident, that 4 months' interest is $\frac{1}{3}$ of a year's interest; and, for the same reason, 1 month's interest is $\frac{1}{4}$ of 4 months' interest; and as 10 days is $\frac{1}{5}$ of a month, the interest for that time is $\frac{1}{5}$ of a month's interest; and if the interest of 10 days be divided by 5, the quotient will be 2 day's interest, and the half of this will be 1 day's interest.

\$7.40.64 Interest as before.

2. What is the interest of \$786.75, from Dec. 9, 1831, to May 11, 1833? Ans. \$67.13.6.

3. What is the interest of \$98.25, from July 4, 1826, to Oct. 19, 1829? Ans. \$19.40.4.

4. What is the interest of \$76.89.5, from Jan. 11, 1822, to July 27, 1833? Ans. \$229.14.2.

5. What is the interest of \$22.76.3, from Feb. 19, 1806, to July 18, 1830? Ans. \$33.34.4.

6. What is the interest of \$76.35, from August 17, 1830, to May 5, 1832? Ans. \$7.86.4.

7 What is the interest of \$97.86, from May 17, 1821, to 28? Ans. \$44.55.8.

8. What is the interest of \$1728.75, from Nov. 19, 1823, to June 18, 1826? Ans. \$267.66.8.

9. What is the interest of \$99.99.9, from Jan. 1, 1800, to Feb. 29, 1832? Ans. \$192.96.4.

10. What is the interest of \$16.76, from Dec. 17, 1811, to June 17, 1822? Ans. \$10.55.8.

11. What is the interest of \$35.61, from Nov. 11, 1831, to Dec. 15, 1833? Ans. \$4.47.4.

12. What is the interest of \$786.97, from Oct. 19, 1827, to Aug. 17, 1831, at $7\frac{1}{2}$ per cent.? Ans. \$245.92.5.

13. What is the interest of \$96.84, from Nov. 27, 1829, to July 3, 1832, at $7\frac{1}{2}$ per cent.? Ans. \$18.88.3.

14. What is the interest of \$111.10.5, from April 17, 1832, to Dec. 7, 1832, at 7 per cent.? Ans. \$4.96.6.

15. What is the interest of \$117.21, from June 19, 1806, to June 17, 1819, at $8\frac{1}{2}$ per cent.? Ans. \$129.46.1.

16. What is the interest of \$17869.75, from Feb. 7, 1830, to Jan. 11, 1832, at 5 per cent.? Ans. \$1722.44.5.

17. What is the interest of \$71.09.1, from July 29, 1823, to June 19, 1827, at 12 per cent.? Ans. \$33.17.5.

18. What is the interest of \$83.47, from Nov. 8, 1830, to July 11, 1833, at $8\frac{3}{4}$ per cent.? Ans. \$19.53.7.

19. What is the interest of \$79.25, from Dec. 8, 1831, to July 17, 1833? Ans. \$7.61.7.

20. What is the interest of \$175.07, from Jan. 7, 1825, to Oct. 12, 1829? Ans. \$50.04.0.

21. What is the interest of \$12.75, from June 16, 1831, to August 20, 1833? Ans. \$1.66.6.

22. What is the interest of \$197.28.5, from Dec. 6, 1832, to Jan. 11, 1834? Ans. \$12.98.7.

23. What is the interest of \$12.69, from Jan. 2, 1833, to Aug. 30, 1834, at 7 per cent.? Ans. \$1.47.5.

24. What is the interest of \$79.15, from Feb. 11, 1831, to June 10, 1833, at $7\frac{1}{4}$ per cent.? Ans. \$13.37.3.

25. What is the amount of \$83.33, from March 11, 1831, to Jan. 1, 1833, at $7\frac{1}{2}$ per cent.? Ans. \$94.61.4.

26. What is the amount of \$100.25, from March 2, 1831, to June 1, 1831, at 4 per cent.? Ans. \$101.24.1.

27. What is the amount of \$369.29, from April 30, 1830, to July 31, 1832, at 9 per cent.? Ans. \$444.16.3.

28. What is the interest of \$769.87, from Jan. 1, 1830, to June 17, 1835, at $9\frac{1}{2}$ per cent.? Ans. \$399.41.2.

29. What is the interest of \$69.75, from Jan. 11, 1833, to June 29, 1833, at $17\frac{1}{2}$ per cent. ? Ans. \$5.69.6.
30. What is the interest of \$368.18, from April, 2, 1816, to June 19, 1835, at 2 per cent. ? Ans. \$141.48.3.
31. What is the interest of \$16.16, from March 3, 1831, to Dec. 6, 1833, at 1 per cent. ? Ans. \$0.44.5.
32. What is the interest of \$1728.19, from May 7, 1824, to July 17, 1830, at $\frac{1}{4}$ per cent. ? Ans. \$26.76.2.
33. What is the interest of \$397.16, from Dec. 29, 1831, to June 30, 1833, at $5\frac{1}{2}$ per cent. ? Ans. \$32.82.6.
34. What is the amount of \$1760.07, from Feb. 17, 1831, to Dec. 19, 1832, at $\frac{1}{2}$ per cent. ? Ans. \$1776.25.2.

CASE IV.

To find the interest of any sum for days.

RULE.—If the rate per cent. be 6, multiply the principal by the number of days, and divide by 6083, and the quotient is the interest; but if the rate per cent. be 5, divide by 7,300.

NOTE.—The reason for dividing by these numbers is, that the interest of any sum at 6 per cent. will amount to the principal in 6083 days; and at 5 per cent. in 7300 days.

EXAMPLES.

1. What is the interest of \$1835, for 35 days ?
Ans. \$10.55.8.
2. What is the interest of \$165.37, for 165 days ?
Ans. \$4.48.5.
3. What is the interest of \$16.87, for 79 days, at 5 per cent. ?
Ans. \$0.18.2.
4. What is the interest of \$167, for 87 days, at 5 per cent. ?
Ans. \$2.00
5. What is the interest of \$761.81, for 165 days ?
Ans. \$20.66.3.
6. What is the interest of 76.18.5, for 315 days, at 5 per cent. ?
Ans. \$3.28.7.
7. What is the interest of \$178.69.7, for 271 days ?
Ans. \$7.96.1.
8. What is the interest of \$1728.79, for 318 days, at 5 per cent. ?
Ans. \$75.30.8.

PARTIAL PAYMENTS.

When notes are paid within one year from the time they become due, it has been the usual custom to find the amount of the principal from the time it became due, until the time of payment; and then to find the amount of each endorsement, from the time it was paid until settlement, and to subtract their sum from the amount of the principal.

EXAMPLES.

(1.) Baltimore, January 1, 1833.

For value received, I promise Riggs, Peabody & Co. to pay them, or order, on demand, one thousand seven hundred and twenty-eight dollars, with interest. John Paywell, Jr.

On this note are the following endorsements. March 1, 1833, received three hundred dollars. May 16, 1833, received one hundred and fifty dollars. September 1, 1833, received two hundred and seventy dollars. December 11, 1833, received one hundred and thirty-five dollars.

What was due at the time of payment, which was December 16, 1833? Ans. \$933.03.

Operation.

| | | |
|---------------------------------------|--------|-----------|
| Principal, | | \$1728.00 |
| Interest for 9 months and 15 days, | | 99.36 |
| | | <hr/> |
| | | \$1827.36 |
| First payment, | 300.00 | |
| Interest for 9 months and 15 days, | 14.25 | |
| Second payment, | 150.00 | |
| Interest for 7 months, | 5.25 | |
| Third payment, | 270.00 | |
| Interest for 3 months and 15 days, | 4.72 | |
| Fourth payment, | 135.00 | |
| Interest for 5 days, | .11 | |
| | <hr/> | \$889.33 |
| | | <hr/> |
| Balance remaining due, Dec. 16, 1833, | | \$918.03 |

(2.)

Concord, Feb. 4, 1834.

For value received, we jointly and severally promise James Thomas, to pay him, or order, on demand, seven hundred dollars, with interest.

Sampson Phillips,

Attest, Henry Dix.

Quails Hoopoo.

On this note are the following payments. March 18, 1834, received one hundred and sixty dollars. June 24, 1834, received two hundred dollars. September 11, 1834, received one hundred and twenty dollars. October 5, 1834, received sixty dollars.

What was due on this note, November 28, 1834 ?

Ans. \$180.43.

(3.)

Portland, May 16, 1834.

For value received, we, Luke A. Homer, as principal, and Daniel D. Snow and Ichabod Frost, as sureties, promise John Webster, to pay him, or order, in one year, six hundred dollars, with interest after three months.

Luke A. Homer,

Daniel D. Snow,

Attest, M. Peters.

Ichabod Frost.

On this note are the following endorsements. Sept. 18, 1834, received one hundred and thirty-six dollars. December 5, 1834, received one hundred and ninety-seven dollars. February 11, 1835, received two hundred dollars. April 19, 1835, received forty dollars.

What was due August 1, 1835 ?

Ans. \$40.31.2.

In the United States' Court, and in most of the Courts of the several States, the following rule is adopted for estimating interest on notes and bonds, when partial payments have been made.

RULE.

Compute the interest on the principal sum, from the time when the interest commenced, to the first time when a payment was made, which exceeds, either alone, or in conjunction with the preceding payments, if any, the interest at that time due; add that interest to the principal, and from the sum subtract the payment made at that time, together with the preceding payments, if any, and the remainder forms a new principal; on which compute and subtract the interest, as upon the first principal, and proceed in the same manner to the time of judgment.

The following example will illustrate the above rule.

(4.)

Boston, June 17, 1827.

For value received, I promise James E. Snow, to pay him, or order, on demand, one hundred and sixty-five dollars and eighteen cents, with interest.

James Y. Frye.

(\$165.18.)

Attest, John True.

On this note are the following endorsements. December 7, 1827, received eighteen dollars and thirteen cents of the within note. October 19, 1828, received twenty-eight dollars and sixteen cents. September 25, 1829, received thirty-six dollars and twelve cents. July 10, 1830, received three dollars and eighteen cents. June 6, 1831, received thirty-six dollars and twenty-eight cents. December 28, 1832, received thirty-one dollars and seventeen cents. May 5, 1833, received three dollars and eighteen cents. September 1, 1833, received twenty-five dollars and eighteen cents. October 18, 1834, received ten dollars.

How much remains due, September 27, 1835?

Ans. \$1541.7.

Method of operation.

| | |
|---|------------------|
| Principal, carrying interest from June 17, 1827, | \$165.18 |
| Interest fr. June 17, 1827, to Dec. 7, 1827, 5 mo. 20 days, | 4.68 |
| | <hr/> |
| | Amount, 169.86 |
| First payment, Dec. 7, 1827, | 18.13 |
| | <hr/> |
| Balance for new principal, | 151.73 |
| Interest fr. Dec. 7, 1827, to Oct. 19, 1828, 10 mo. 12 da. | 7.88.9 |
| | <hr/> |
| | Amount, 159.61.9 |
| Second payment, Oct. 19, 1828, | 28.16 |
| | <hr/> |
| Balance for new principal, | 131.45.9 |
| Interest fr. Oct. 19, 1828, to Sept. 25, 1829, 11 mo. 6 da. | 7.36.1 |
| | <hr/> |
| | Amount, 138.82.0 |
| Third payment, Sept. 25, 1829, | 36.12.0 |
| | <hr/> |
| Balance for new principal, | 102.70.0 |
| Interest fr. Sept. 25, 1829, to June 6, 1831, 20 mo. 11 da. | 10.45.8 |
| | <hr/> |
| | Amount, 113.15.8 |

Brought forward, 113.15.8

Fourth pay't, July 10, 1830, a sum less than int'st, 3.18

Fifth pay't, June 6, 1831, a sum greater than int. 36.28

39.46

Balance for new principal, 73.69.8

Interest fr. June 6, 1831, to Dec. 28, 1832, 18 mo. 22 da. 6.90.3

Amount, 80.60.1

Sixth payment, Dec. 28, 1832, 31.17.0

Balance for new principal, 49.43.1

Interest fr. Dec. 28, 1832, to May 5, 1833, 4 mo. 22 da. 1.04.6

Amount, 50.47.7

Seventh payment, May 5, 1833, 3.18

Balance for new principal, 47.29.7

Interest fr. May 7, 1833, to Sept. 1, 1833, 3 mo. 26 da. 91.4

Amount, 48.21.1

Eighth payment, Sept. 1, 1833, 25.18.0

Balance for new principal, 23.03.1

Interest fr. Sept. 1, 1833, to Oct. 18, 1834, 13 mo. 17 da. 1.56.2

Amount, 24.59.3

Ninth payment, 10.00.0

Balance for new principal, 14.59.3

Interest fr. Oct. 18, 1834, to Sept. 27, 1835, 11 mo. 9 da. 82.4

Balance due at the time of payment, \$15.41.7

(5.)

Salem, June 17, 1829.

For value received, I promise L. Swan, to pay him, or order, on demand, seven hundred and sixty-nine dollars and eighty-seven cents, with interest.

Samuel Q. Peters.

Attest, Moses Haynes.

On this note are the following payments. March 1, 1830, received seventy-five dollars and fifty cents. June 11, 1831, received one hundred

and sixty-five dollars. September 15, 1831, received one hundred and sixty-one dollars. June 21, 1832, received forty-seven dollars and twenty-five cents. March 5, 1833, received twelve dollars and seventeen cents. December 6, 1833, received ninety-eight dollars. July 7, 1834, received one hundred and sixty-nine dollars.

What remains due Sept. 25, 1835 ? Ans. \$226.29.7.

(6.) Haverhill, April 30, 1831.

For value received, I promise Kimball & Hammond, to pay them, or order, on demand, three hundred dollars, with interest.

Simpson W. Leavet.

Attest, James Quintire.

The following partial payments were made on this note. June 27, 1832, received one hundred and fifty dollars. December 9, 1832, received one hundred and fifty dollars.

What was due Oct. 9, 1833 ? Ans. \$26.73.5.

(7.) New-York, Feb. 11, 1832.

For value received, I promise John Trow, to pay him, or order, on demand, fifty-four dollars, and eighteen cents, with interest.

Luke M. Sampson.

On this note are the following payments. July 11, 1833, received twelve dollars and twenty-five cents. August 15, 1834, received two dollars and ten cents. July 9, 1835, received three dollars and twelve cents. August 21, 1835, received thirty-seven dollars and eighteen cents.

What was due Dec. 17, 1835 ? Ans. \$10.22.4.

(8.) Boston, Jan. 7, 1831.

For value received, we jointly and severally promise Jones, Oliver & Co. to pay them, or order, on demand, one thousand seven hundred and twenty-eight dollars, with interest.

John Bountiful,

Attest, Timothy True.

James Trusty.

On this note are the following payments. February 9, 1832, received seven hundred and sixty dollars and twenty-eight cents and five mills. March 5, 1833, received sixty-eight dollars and fifty cents. December 28, 1833, received eight hundred and seventy-six dollars and twenty-eight cents. July 17, 1834, received sixty dollars.

What was due at the time of payment, which was Oct. 1, 1834 ? Ans. \$209.22.9.

(9.) Philadelphia, May 7, 1829.

For value received, I promise John Jordan, to pay him, or order, on demand, five hundred dollars, with interest.

Thomas C. True.

The following partial payments were endorsed on this note. June 29, 1830, received one hundred dollars. December 5, 1831, received one hundred dollars. March 12, 1832, received five dollars. July 4, 1833, received ninety-five dollars. December 1, 1833, received two hundred dollars.

What was due Jan. 1, 1835? Ans. \$141.50.4.

(10.) Newburyport, March 19, 1831.

For value received, we, jointly and severally, promise John Frost, to pay him, or order, on demand, eighty-nine dollars and seventy-five cents, with interest.

Attest, James Snow.

Henry Augustus,
Marcus T. Cicero.

On this note are the following endorsements. December 6, 1831, received twelve dollars and twelve cents. February 17, 1832, received twelve dollars and twelve cents. March 19, 1833, received three dollars and sixteen cents. December 28, 1834, received two dollars and eighteen cents. January 1, 1835, received twenty-five dollars and twenty-five cents. March 11, 1835, received thirty-one dollars and eighteen cents. July 17, 1835, received five dollars and eighteen cents. September 1, 1835, received six dollars and twenty-nine cents.

What was due Dec. 29, 1835? Ans. \$10.57.

The following rule is established by the Supreme Court of the State of Connecticut.

RULE.

Compute the interest to the time of the first payment; if that be one year or more from the time the interest commenced, add it to the principal, and deduct the payment from the sum total. If there be after payments made, compute the interest on the balance due to the next payment, and then deduct the payment as above; and, in like manner, from one payment to another, till all the payments are absorbed; provided the time between one payment and another be one year or more. But if any payments be made before one year's interest hath accrued, then compute the interest on the principal sum due on the obligation, for one year, add it to the principal, and compute the interest on the sum paid, from the time it was paid, up to the end of the

year; add it to the sum paid, and deduct that sum from the principal and interest, added together.*

If any payments be made of a less sum than the interest arisen at the time of such payment, no interest is to be computed, but only on the principal sum for any period.

(11.) Weathersfield, June 1, 1828.

For value received, I promise J. D. to pay him, or order, nine hundred dollars, on demand, with interest.

James L. Emerson.

On this note are the following endorsements. June 16, 1829, received two hundred dollars of the within note. August 1, 1830, received one hundred and sixty dollars. November 16, 1830, received seventy-five dollars. February 1, 1832, received two hundred and twenty dollars.

What was due August 1, 1832?

Ans. \$585.82

Operation.

| | |
|---|----------------|
| Principal, | \$900.00 |
| Interest from June 1, 1828, to June 16, 1828, 12½ mo. | 56.50 |
| | <hr/> 956.50 |
| First payment, | 200.00 |
| | <hr/> 756.50 |
| Interest from June 16, 1828, to Aug. 1, 1830, 13¼ mo. | 51.06.3 |
| | <hr/> 807.56.3 |
| Second payment, | 160 |
| | <hr/> 767.56.3 |
| Interest for one year, | 46.05.3 |
| | <hr/> 813.62.6 |
| Am't of 3d pay't, fr. Nov. 16, 1830, to Aug. 1, 1831, 8½ m. | 78.18.7 |
| | <hr/> 735.43.9 |
| Interest from Nov. 16, 1830, to Feb. 1, 1832, 14½ mo. | 53.31.9 |
| | <hr/> 788.75.8 |

* If the year extends beyond the time of payment, find the amount of the remaining principal to the time of payment; find, also, the amount of endorsement, or endorsements, and subtract their sum from the amount of the principal.

| | |
|--|---------------------------|
| | Brought forward, 788.75.8 |
| Fourth payment, | 220. |
| | <hr/> |
| Interest from Feb. 1, 1832, to Aug. 1, 1832, 6 mo. | 568.75.8 |
| | 17.06.2 |
| | <hr/> |
| Balance due August 1, 1832, | \$585.82.0 |

Principal, interest, and time given to find the rate per cent.

RULE.

Divide the interest given, by the interest of the given sum, at 1 per cent. for the given time; the quotient will be the rate per cent. required.

EXAMPLES.

1. At what rate per cent. must \$500 be on interest, to gain \$120 in 4 years? Ans. 6 per cent.
2. At what rate per cent. must \$120 be on interest, to amount to \$133.20 in 16 months? Ans. $8\frac{1}{4}$ per cent.

Principal, interest, and rate per cent. given, to find the time.

RULE.

Divide the given interest by the interest of the principal for 1 year, and the quotient is the time.

EXAMPLES.

1. How long must \$500 be on interest, at 6 per cent. to gain \$120? Ans. 4 years.
2. How long must \$120 be on interest, at $8\frac{1}{4}$ per cent. to amount to \$133.20? Ans. 16 months.

Interest, time, and rate per cent. given, to find the principal.

RULE.

Divide the given interest by the interest of 1 dollar, for the given rate and time.

EXAMPLES.

1. What principal, at 6 per cent. is sufficient, in 4 years, to ? \$120? Ans. \$500.

2. What principal, at $8\frac{1}{4}$ per cent. is sufficient, in 16 months, to gain \$13.20 ?

Ans. \$120.00.

MISCELLANEOUS QUESTIONS.

1. A merchant, having \$1728 in the Union Bank, wishes to withdraw 15 per cent. ; how much will remain ?

Ans. \$1468.80.

2. A gentleman has an estate of \$15.000. He has given $12\frac{1}{2}$ per cent. to his wife, and 25 per cent. of the remainder to his children ; how much will he have left ?

Ans. \$9843.75.

3. What is the difference between $12\frac{1}{2}$ per cent. of \$560, and 18 per cent. of \$400 ?

Ans. \$2.00.

4. A merchant expended \$1890 as follows. He laid out 12 per cent. of his money for calicoes ; 20 per cent. for hardware ; 30 per cent. for broadcloths ; and with the remainder he bought 2646 pounds of sugar ; what did it cost him a pound ?

Ans. \$0.20.

COMMISSION AND BROKERAGE.

Commission and Brokerage are compensations made to factors, brokers, and other agents, for their services, either for buying or selling goods.

NOTE.—A factor is an agent, employed by merchants, *residing in other places*, to buy and sell, and to transact business on their account. A Broker is an agent employed by merchants to transact business.

RULE.

The method of operation is the same as in interest.

EXAMPLES.

1. My agent in New-Orleans, has purchased cotton, on my account, to the amount of \$18768; what is his commission, at $1\frac{1}{4}$ per cent. ? Ans. \$328.44.

2. If a broker sells goods for me to the amount of \$896, what is his commission, at 2 per cent. ? Ans. \$17.92.

3. My factor, in London, writes that, he has purchased for me to the amount of 395*£*. 15*s*. 5*d*.; what is his commission, at $2\frac{1}{4}$ per cent. ? Ans. 8*£*. 18*s*. 1*d*.

4. A factor receives \$1976, which he is to lay out for goods; having deducted his commission of 4 per cent. how much will remain to be laid out ? Ans. \$1900.

NOTE.—As his commission is to be taken out of the sum *remitted*, he will *not* receive 4 dollars on every 100, but 4 on every 104; that is, he will receive $\frac{4}{104}$.

5. I have remitted to my correspondent a certain sum of money, which he is to lay out for me, and, having reserved to himself $2\frac{1}{4}$ per cent. on the purchase, which amounted to \$90, he buys for me at \$95 per ton, 37*T*. 17*cwt*. 3*qr*. 16*lb*. of iron; what was the sum remitted ? Ans. \$3690.

STOCKS.

Stocks is a general name used for funds, established by government, or individuals, in their corporate capacity, the value of which is often variable.

The method for computation is the same as in interest.

EXAMPLES.

1. What is the value of \$24360 of the National Bank stock, at 135 per cent. ?

$$24360 \times 1.35 = \$32886 \text{ Answer.}$$

2. Sold 15 shares, \$100 each, of the Boston Bank, at 13 per cent. advance. To what did they amount ?

$$\text{Ans. \$1695.}$$

3. What must I give for 12 shares in the Haverhill Bank, at 15 per cent. advance, shares being \$100 each ?

Ans. \$1800.

4. What is the purchase of 1058*l.* 12*s.* bank stock, at 115*½* per cent. ?

Ans. 1225*l.* 6*s.* 6*d.*

INSURANCE AND POLICIES.

Insurance is a security, by paying a certain sum, to indemnify the secured against such losses as shall be specified in the policy.

Policy is the name of the writ, or instrument, by which the contract or indemnity is effected between the parties.

NOTE.—If the average loss does not exceed 5 per cent. the *underwriters* are free, and the insured bears the loss himself.

RULE.

The same as in interest.

EXAMPLES.

1. What is the premium on \$896, at 12 per cent. ?

Ans. \$157.25.

2. What is the premium on \$850, at 18*½* per cent. ?

Ans. \$107.52.

3. What is the premium of insuring \$9870, at 7 per cent. ?

Ans. \$690.90.

4. What sum must be secured for a policy of \$1728, deducting 15 per cent. ?

Ans. \$1702.08.

5. What sum must a policy be taken out for, to cover \$2475, when the premium is 10 per cent. ?

Ans. \$2500.

NOTE.—As 10 per cent. is already taken out, the sum covered must be $\frac{20}{100}$ of the policy.

6. A certain company own a cotton factory, valued at \$26250. For what sum must a policy be taken out, to cover the whole property, at 12*½* per cent. ?

Ans. \$30.000.

7. If a policy be taken out, for \$3600, at 40 per cent. what is the sum covered ?
 Ans. \$2160.

NOTE.—It is evident, that, if 40 per cent. be taken from any sum, 60 per cent. will be left.

8. If a policy be taken out for \$600, at 10 per cent., what is the sum covered ?
 Ans. \$540.

9. If a policy be taken out for \$1250, to cover \$500, what is the premium per cent. ?
 Ans. 60 per cent.

10. A merchant adventured \$1000 from Boston to New-Orleans, at 3 per cent. ; from thence to Chili, at 5 per cent. ; and thence to Canton, at 6 per cent. ; and from thence to Boston, at 7 per cent. For what sum must he take out a policy, to cover his adventure the voyage round ?
 Ans. \$1241.34.8+.

COMPOUND INTEREST.

The law specifies, that the borrower of money shall pay a certain number of dollars, called *per cent.*, for the use of one hundred dollars for a year. Now, if this *borrower* does not pay to the *lender* this *per cent.* at the *end* of the year, it is no more than just, that he should pay interest for the use of it, so long as he shall keep it in his possession ; and this is called *Compound Interest*.

RULE.

Find the interest of the given sum for one year, and add it to the principal ; then find the interest of this amount for the next year ; and so continue, until the time of settlement. Subtract the principal from the last amount, and the remainder is the compound interest.

EXAMPLES.

1. What is the compound interest of \$300 for 3 years ?
 Ans. \$57.90.4.

$$\begin{array}{r} 5 = \frac{1}{20}) 300 \\ 1 = \frac{1}{5}) 15 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 318 \\ 1 = \frac{1}{5}) 15.90 \\ \hline 3.18 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 318 \\ 1 = \frac{1}{5}) 15.90 \\ \hline 3.18 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 318 \\ 1 = \frac{1}{5}) 15.90 \\ \hline 3.18 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 337.08 \\ 1 = \frac{1}{5}) 16.854 \\ \hline 3.37.0 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 337.08 \\ 1 = \frac{1}{5}) 16.854 \\ \hline 3.37.0 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 337.08 \\ 1 = \frac{1}{5}) 16.854 \\ \hline 3.37.0 \end{array}$$

$$\begin{array}{r} 5 = \frac{1}{20}) 337.08 \\ 1 = \frac{1}{5}) 16.854 \\ \hline 3.37.0 \end{array}$$

\$57.30.4=Answer as before.

Another method.

$$\begin{array}{r} 300 = \text{Principal.} \\ .06 \end{array}$$

$$\begin{array}{r} 18.00 = \text{Interest for 1 year.} \\ 300 \end{array}$$

$$\begin{array}{r} 318.00 = \text{Amount for 1 year.} \\ .06 \end{array}$$

$$\begin{array}{r} 19.08 = \text{Interest for second year.} \\ 318 \end{array}$$

$$\begin{array}{r} 337.08 = \text{Amount for 2 years.} \\ .06 \end{array}$$

$$\begin{array}{r} 20.22.48 = \text{Interest for third year.} \\ 337.08 \end{array}$$

$$\begin{array}{r} 357.30.48 = \text{Amount for 3 years.} \\ 300 \end{array}$$

\$57.30.48=Compound interest for 3 years.

2. What is the amount of \$500 for 3 years?

Ans. \$598.50.8.

3. What is the compound interest of \$345 for 10 years?

Ans. \$272.84.2.

4. What is the compound interest of \$316 for 3 years, 4 months, and 18 days?

Ans. \$69.01.7.

5. What is the compound interest of \$970 for 2 years, 9 months, and 24 days?

Ans. \$173.29.5.

By the aid of the following Table, calculations are more easily effected, than by the preceding rule.

TABLE,

Showing the amount of 1 dollar, or pound, for any number of years under 50, at 5 and 6 per cent., compound interest.

| Years. | 5 per cent. | 6 per cent. | Years. | 5 per cent. | 6 per cent. |
|--------|-------------|-------------|--------|-------------|-------------|
| 1 | 1.050000 | 1.060000 | 14 | 1.979931 | 2.260903 |
| 2 | 1.102500 | 1.123600 | 15 | 2.078928 | 2.396558 |
| 3 | 1.157625 | 1.191016 | 16 | 2.182874 | 2.547271 |
| 4 | 1.215506 | 1.262479 | 17 | 2.292018 | 2.692772 |
| 5 | 1.276281 | 1.338225 | 18 | 2.406619 | 2.854339 |
| 6 | 1.340095 | 1.418519 | 19 | 2.526950 | 3.025599 |
| 7 | 1.407100 | 1.503630 | 20 | 2.653297 | 3.207135 |
| 8 | 1.477455 | 1.593848 | 21 | 2.785962 | 3.399563 |
| 9 | 1.551328 | 1.689478 | 22 | 2.925260 | 3.603537 |
| 10 | 1.628894 | 1.790847 | 23 | 3.071523 | 3.819749 |
| 11 | 1.710339 | 1.898298 | 24 | 3.225099 | 4.048934 |
| 12 | 1.795856 | 2.012196 | 25 | 3.386354 | 4.291870 |
| 13 | 1.885649 | 2.132928 | 26 | 3.555672 | 4.549382 |

| Years. | 5 per cent. | 6 per cent. | Years. | 5 per cent. | 6 per cent. |
|--------|-------------|-------------|--------|-------------|-------------|
| 27 | 3.733456 | 4.822345 | 39 | 6.704751 | 9.703507 |
| 28 | 3.920129 | 5.111686 | 40 | 7.039988 | 10.285717 |
| 29 | 4.116135 | 5.418387 | 41 | 7.391988 | 10.902860 |
| 30 | 4.321942 | 5.743491 | 42 | 7.761587 | 11.557032 |
| 31 | 4.538039 | 6.088100 | 43 | 8.149666 | 12.250454 |
| 32 | 4.764941 | 6.453386 | 44 | 8.557150 | 12.985481 |
| 33 | 5.003188 | 6.840589 | 45 | 8.985007 | 13.762610 |
| 34 | 5.253347 | 7.251025 | 46 | 9.434258 | 14.588367 |
| 35 | 5.516015 | 7.686086 | 47 | 9.905971 | 15.463669 |
| 36 | 5.791810 | 8.147252 | 48 | 10.401269 | 16.391489 |
| 37 | 6.081406 | 8.636087 | 49 | 10.921333 | 17.374978 |
| 38 | 6.385477 | 9.154252 | 50 | 11.467369 | 18.217477 |

To perform questions by the Table, multiply the amount of one dollar by the given rate and time found in the Table, by the principal, and from the product subtract the principal, and the remainder is the compound interest.

NOTE—If there be months and days, find the amount for them on the number taken from the Table, *before* it is multiplied by the principal.

EXAMPLES.

6. What is the compound interest of \$360, for 5 years, 6 months, and 24 days ? Ans. \$138.14.

1.338225=Amount of one dollar for 5 years.

.034=Ratio for 6 months and 24 days.

5.352900

40.14675

.045499650

1.338225

1.383724650=Amount of 1 dollar, for 5 yrs. 6 mo. 24 da.
360

83023479000

415117395

498.14.0874000=Amo't of principal for 5 yrs. 6 mo. 24 da.
360

138.14=Compound interest of the principal for do.

7. What is the interest of \$890, for 30 years ?

Ans. \$4221.70.6.

8. What is the amount of \$480, for 40 years ?

Ans. \$4937.14.4.

9. What is the interest of \$300 for 10 years, 7 months, and 15 days ?

Ans. \$257.41.4.

10. What is the amount of \$586, for 12 years, 1 month, and 29 days, at 5 per cent. ?

Ans. \$1060.99.5.

11. The probable number of blacks, at this time, (1835) in the United States, is 2,500,000. Now, supposing their increase to be 25 per cent. for every 10 years, what will be their number in the year 1935 ?

Ans. 23,283,057.

12. Supposing the annual increase of the people of color to be 2 per cent.; how many must be sent out of the country, each year, that their numbers might not increase ?

Ans. 50,000.

To find the amount of a note by compound interest, when there have been partial payments.

RULE.

Find the amount of the principal, and from it subtract the amount of the endorsements.

EXAMPLES.

13. A., by his note, dated January 1, 1830, promises to pay B. \$500 on demand.

On this note are the following endorsements. July 16, 1830, received two hundred dollars. August 21, 1831, received two hundred dollars. December 1, 1832, received one hundred dollars.

What was the balance Sept. 1, 1834? Ans. \$52.73.0.

(\$100.)

Boston, Sept. 25, 1833.

For value received, I promise Peter Absalom, to pay him, or order, on demand, one hundred dollars, with interest after six months.

J. P. Jay.

On this note are the following endorsements. June 11, 1834, received fifty dollars. Sept. 25, 1834, received fifty dollars.

What was due August 25, 1835? Ans. \$2.24.7.

PRACTICE.

Practice is an expeditious way of performing questions in Compound Multiplication and Proportion.

RULE.

Assume the price at some unit higher than the given price; that is, if the price be pence, or pence and farthings, assume the price at a shilling a yard, or pound, &c. If the price be in shillings, or shillings and pence, &c., assume the price at a pound, a yard, &c.; then take the aliquot parts of a pound.

TABLE,

Showing the aliquot parts of money and weights.

| Parts of a £. | | | Parts of a ton. | | | Parts of half a cwt. | | |
|----------------------|----|----------------|-----------------|-----|----------------|----------------------|----|----------------|
| s. | d. | | cwt. | qr. | | lb. | | |
| 10 | is | $\frac{1}{2}$ | 10 | is | $\frac{1}{2}$ | 28 | is | $\frac{1}{2}$ |
| 6 | 8 | " | 5 | " | $\frac{1}{4}$ | 14 | " | $\frac{1}{4}$ |
| 5 | " | $\frac{1}{4}$ | 4 | " | $\frac{1}{5}$ | 8 | " | $\frac{1}{5}$ |
| 4 | " | $\frac{1}{5}$ | 2 | 2 | " | 7 | " | $\frac{1}{8}$ |
| 3 | 4 | " | 2 | " | $\frac{1}{10}$ | 4 | " | $\frac{1}{14}$ |
| 2 | 6 | " | 1 | " | $\frac{1}{20}$ | 3½ | " | $\frac{1}{8}$ |
| 2 | " | $\frac{1}{10}$ | | | | 2 | " | $\frac{1}{28}$ |
| 1 | 8 | " | Parts of a cwt. | | | Parts of a 14 cwt. | | |
| 1 | " | $\frac{1}{20}$ | qrs. lb. | | | lb. | | |
| Parts of a shilling. | | | 2 | is | $\frac{1}{2}$ | 14 | is | $\frac{1}{2}$ |
| d. | | | 1 | " | $\frac{1}{4}$ | 7 | " | $\frac{1}{4}$ |
| 6 | is | $\frac{1}{2}$ | 16 | " | $\frac{1}{5}$ | 4 | " | $\frac{1}{7}$ |
| 4 | " | $\frac{1}{3}$ | 14 | " | $\frac{1}{8}$ | 3½ | " | $\frac{1}{8}$ |
| 3 | " | $\frac{1}{4}$ | 8 | " | $\frac{1}{14}$ | 2 | " | $\frac{1}{14}$ |
| 2 | " | $\frac{1}{6}$ | 7 | " | $\frac{1}{16}$ | 1 | " | $\frac{1}{28}$ |
| 1½ | " | $\frac{1}{8}$ | 4 | " | $\frac{1}{28}$ | | | |
| 1 | " | $\frac{1}{12}$ | 2 | " | $\frac{1}{56}$ | | | |

EXAMPLES.

1. What will 386 yards of ribbon cost, at 6 pence a yard?

Ans. 9£. 4s.

$$6d. = \frac{1}{2})368s.$$

$$\begin{array}{r} 20)184 \\ \hline \end{array}$$

9£ 4s.

We assume the price at a shilling a yard, and then say, if 368 shillings be the price, at a shilling a yard, at 6 pence it must be half as much, viz. 184 shillings. We then reduce the shillings to pounds.

2. What will 4785 yards of cotton cost, at 8 pence per yard?

Ans. 15£. 10s. 0d.

6d. $= \frac{1}{2}$) 4785s. = Price at 1 shilling.

2d. $= \frac{1}{2}$) 2392-6 = Price at 6d.

797-6 = Price at 2d.

20) 3190 = 0

159£ 10s. 0d. = Price at 8d.

Having found the price at 6d. as before, we find it for the 2d., by saying, that 2d. is $\frac{1}{3}$ of 6d.

3. What is the interest of \$368, at 15 per cent. ?

Ans. \$55.20.

10 per cent. $= \frac{1}{10}$) 368

5 $= \frac{1}{2}$) 3680
1840

\$55.20

10 per cent. is $\frac{1}{10}$ of the principal, and 5 per cent. is $\frac{1}{2}$ of 10 per cent.

4. What is the value of 17 acres, 3 roods, and 35 rods of land, at \$80 per acre ?

Ans. \$1437.50.

80

17

560

80

1360 = Pr. of 17A.

2R. $= \frac{1}{2}$) 40 = do. of 2R.

1R. $= \frac{1}{2}$) 20 = do. of 1R.

2r. $= \frac{1}{2}$) 10 = do. of 20r.

1r. $= \frac{1}{2}$) 5 = do. of 10r.

5r. $= \frac{1}{2}$) 2.50 = do. of 5r.

By dividing the price of 1 acre by 2, we obtain the price of 2R.; and by halving this, we find the price of 1R.; and as 20 rods is half of a rood, its value will be one half; and in the same manner 10 rods will be half the price of 20 rods, and 5 rods will be half the price of 10 r.

\$1437.50 = Price of 17A. 3R. 35rd.

5. What cost 14 tons, 15 cwt. 3 qr. 21 lbs. of iron, at \$120 per ton ?

Ans. \$1775.62.5.

120

14

1680.00 = price of 14T.

10 cwt. $= \frac{1}{2}$) 60.00 = do. of 10cwt.

1740.00 Carried forward.

Brought forward, \$1740.00

| | |
|---------------------------|----------------------|
| 5 cwt. = $\frac{1}{2}$) | 30.00 = do. of 5cwt. |
| 2 qr. = $\frac{1}{4}$) | 3.00 = do. of 2qr. |
| 1 qr. = $\frac{1}{2}$) | 1.50 = do. of 1qr. |
| 14 lbs. = $\frac{1}{2}$) | 75 = do. of 14lb. |
| 7 lbs. = $\frac{1}{2}$) | 375 = do. of 7lbs. |

\$1775.625 = do. 14T. 15cwt. 3gr. 21lb.

6. What cost 387 lbs. of sugar, at 9 pence a pound?
Ans. 14£. 10s. 3d.
7. What cost 498 lbs. of green tea, at 2 shillings and 6 pence per pound?
Ans. 62£. 5s. 0d.
8. What cost 384 yards of cloth, at 4 shillings and 9 pence a yard?
Ans. 91£. 4s. 0d.
9. What cost 714 yards of broadcloth, at 15 shillings and 6 pence per yard?
Ans. 553£. 7s. 0d.
10. What cost 16 cwt. 3 quarters, and 10 lbs. of copperas, at \$2.50 per cwt.?
Ans. \$42.09.7.
11. What cost 27 cwt. 1 quarter, 21 lbs. of coffee, at \$14 per cwt.?
Ans. \$384.12 $\frac{1}{2}$.
12. What cost 7 tons, 13 cwt. 2 quarters, and 7 lbs. of hay, at \$24.60 per ton?
Ans. \$188.88.1 $\frac{1}{2}$.
13. If 1 acre of land cost \$80.50, what will 25 acres, 2 roods, and 35 rods cost?
Ans. \$2070.35.9 $\frac{3}{4}$.
14. If 1 acre cost \$32.32, what will 51 acres, 0 qr. 15 rods cost?
Ans. \$1651.35.
15. If 1 yard of cloth cost \$5.60, what will 7 yards, 3 qrs. and 2 nails cost?
Ans. \$44.10.
16. What is the premium on \$6780, at 12 $\frac{1}{2}$ per cent.?
Ans. \$847.50.
17. What is the interest of \$1728, for 5 years, 7 months, and 20 days?
Ans. \$584.64.
18. What will 19 tons, 19 cwt. 3 qr. 27 $\frac{1}{2}$ lbs. of copperas cost at 19£ 19s. 11 $\frac{1}{2}$ d. per ton?
Ans. 399£ 19s. 51 $\frac{1}{2}$ d.

RATIO.

Ratio is the mutual relation, which any one magnitude, or number has to another of the same kind, without the intervention of a third. Thus the ratio of 10 to 5 $= \frac{10}{5} = 2$. Ratio of 7 to 21 $= \frac{7}{21} = \frac{1}{3}$. Ratio 5 to 10 $= \frac{5}{10} = \frac{1}{2}$, &c. Quantities of different kinds have no ratio to each other; as no one would inquire, how often 5 dollars were contained in 15 miles, or what part of 8 bushels were 2 minutes.

A ratio shows how many times one number, or term, is contained in another.

PROPORTION.

Proportion is the likeness or equalities of ratios. Thus, because 5 has the same relation or ratio to 10 that 8 has to 16, we say such numbers are in *proportion* to each other, and are therefore called *proportionals*.

If any four numbers whatever be taken, the first is said to have the same ratio or relation to the second, that the third has to the fourth, when the first number or term contains the second, as many times as the third contains the fourth; or when the second contains the first, as many times as the fourth does the third. Thus 8 has the same ratio to 4, that 12 has to 6; because 8 contains 4, as many times as 12 does 6. And 3 has the same relation to 9, that 4 has to 12; because 9 contains 3, as many times as 12 does 4. Ratios are represented by colons; and the equalities of ratios by double colons.

3 : 9 :: 8 : 24 is read thus; 3 has the same ratio or relation to 9, as 8 to 24. The first and third numbers of a proportion are called *antecedents*, and the second and fourth are called *consequents*; also, the first and fourth are called *extremes*, and the second and third are called *means*.

Whatever four numbers are proportionals, if their antecedents or consequents be multiplied or divided by the same numbers, they are still proportionals; and if the terms of one proportion be multiplied or divided by the corresponding term of another proportion, their products and quotients are still proportionals.

This will appear evident, from the various changes that the following example admits.

$$\begin{array}{l}
 4 : 8 :: 3 : 6 \text{ Directly.} \\
 8 : 4 :: 6 : 3 \text{ By inversion.} \\
 4 : 3 :: 8 : 6 \text{ By permutation.} \\
 4+8 : 8 :: 3+6 : 6 \text{ By composition.} \\
 4 : 4+8 :: 3 : 3+6 \text{ By composition.} \\
 4 : 8-4 :: 3 : 6-3 \text{ By division.} \\
 8-4 : 8 :: 6-3 : 6 \text{ By division.} \\
 4 \times 4 : 8 \times 8 :: 3 \times 3 : 6 \times 6 \text{ By compound ratios.} \\
 \frac{4}{8} : \frac{8}{4} :: \frac{3}{6} : \frac{6}{3} \text{ By division.}
 \end{array}$$

That the product of the extremes is equal to that of the means, is evident from the following consideration. Let the following proportionals be taken. $12 : 3 :: 8 : 2$. From the definition of proportion, the first term contains the second as many times as the third does the fourth; therefore, $\frac{12}{3} = \frac{8}{2}$, but $\frac{12}{3} = 4$, and $\frac{8}{2} = 4$; and if 24, the numerator of the first fraction, which is a substitute for the first term, be multiplied by 6, the denominator of the second fraction, and a substitute for the fourth term, the product will be the same as if 6, the denominator of the first fraction, and a substitute for the second term, be multiplied by 24, the numerator of the second fraction, and a substitute for the third term. Thus, $24 \times 6 = 6 \times 24$. Therefore the product of the extremes is, in all cases, equal to that of the means.

If, then, one of the extremes be wanting, divide the product of the means by one of the extremes; or, if one of the means be wanting, divide the product of the extremes by one of the means.

To apply this, we will take the following question. If 5 yards of cloth cost \$15, what will 7 yards cost? It is evident, that twice the quantity of cloth would cost twice the sum, and that three times the quantity, three times the sum, &c.—That is, the price will be in *proportion* to the quantity purchased. We then have three terms of a proportion given; one of the extremes and the two means, to find the other extreme.

Thus, $5 : 7 :: 15$. Therefore, to find the other extreme by the rule above stated, we multiply the two means, 7 and 15, and divide their product by the extreme given, and the quotient is the extreme required. $7 \times 15 = 105$. $105 \div 5 = 21$ dollars, the answer required.

To perform this question by analysis, we reason thus. If 5 yards cost 15 dollars, 1 yard will cost one-fifth as much, which is 3 dollars; and if 1 yard cost 3 dollars, 7 yards will cost 7 times as much, which is 21 dollars.

From the illustrations above given, we deduce the following

RULE.*

State the question by making that number which is of the same name, or quality of the answer required the third term; then if the answer required is to be greater than the third term, make the second term greater than the first; but if the answer is to be less than the third term, make the second less than the first.

Reduce the first and second terms to the lowest denomination, mentioned in either, and the third term to the lowest denomination mentioned in it.

Multiply the second and third term together, and divide their product by the first, and the quotient is the answer in the same denomination to which the third is reduced.

If any thing remains after division, reduce it to the next lowest denomination, and divide as before.

If either of the terms consists of fractions, state the question, as in whole numbers, and reduce the mixed numbers to improper fractions, compound fractions to simple ones, and invert the first term, and then multiply the three terms continually together, and the product is the answer to the question. Or the fractions may be reduced to a common denominator; and

* This rule was formerly divided into the Rule of Three Direct, and Rule of Three Inverse. The Rule of Three Direct, included those questions, when *more required more, and less required less*, thus; If 5 lbs. of coffee cost 60 cents, what would be value of 10 lbs., would be a question in the Rule of Three Direct, because the more coffee there was, the more money it would take to purchase it.

But if the question were thus. If 4 men can mow a certain field in 12 days, how long would it take 8 men; it would be in inverse, because the more men, the less would be the time to perform the labor, that is, *more would require less*.

The method for stating questions was this, make that number which is the demand of the question, the third term, that which is of the same name the first, and that which is of the same name as the answer required, the second term.

If the question was direct, the first and second terms must be multiplied together, and their product divided by the first; but if it was inverse, the first and second terms must be multiplied together, and their product divided by the third.

their numerators, may be used as whole numbers. For when fractions are reduced to a common denominator, their value is as their numerators.

NOTE.—In the Rule of Three, the second term is the quantity whose price is wanted; the third term is the value of the first term; when, therefore, the second term is multiplied by the third, the answer is as much more than it should be, as the first term is greater than unity; therefore, by dividing the first term, we have the value of the quantity required. Or by multiplying the third, by the number of times which the second contains the first, will produce the answer.

NOTE 2.—The pupil should perform every question by Analysis, previous to his performing them by Proportion.

EXAMPLES.

1. If a man travels 243 miles in 9 days, how far will he travel in 24 days ?

Ans. 648m.

$$\begin{array}{rcl} \text{D.} & \text{ds.} & \text{miles.} \\ 9 & : & 24 :: 243 \\ & & 24 \end{array}$$

$$\begin{array}{r} 972 \\ 586 \\ \hline 9)5832 \end{array}$$

Ans.=648m.

As the answer to the question must be in miles, we make the third term miles (243); and from the nature of the question, we know that he will travel farther in 24 days than in 9 days, we therefore place 24 as the larger, of the two remaining terms in the *second place*, and the remaining number, 9 days, in the *first place*.

To perform this question by *analysis*, we proceed thus. If he travel 243 miles in 9 days, he will in one day travel $\frac{1}{9}$ of 243 miles, which is 27 miles; then if he travel 27 miles in one day, in 24 days he will travel 24 times as far, which is 648 miles, the answer as before.

2. If 17 yards of broadcloth cost \$102.00, what will 7 yards cost ?

Ans. \$42.00.

$$\begin{array}{rcl} \text{Yds.} & \text{yds.} & \$ \\ 17 & : & 7 :: 102 \\ & & 7 \end{array}$$

$$\begin{array}{r} 17)714(42 \\ 68 \end{array}$$

$$\begin{array}{r} 34 \\ 34 \end{array}$$

As the answer is to be in dollars, we make the third dollars (102), and as 7 yards will not cost so much as 17 yards, we make the second term, (7) less than the first, (17.)

To perform this question by *analysis*, we reason thus. If 17 yards cost \$102, one yard will cost $\frac{1}{17}$ of \$102, which is \$6, and if one yard cost \$6.00, 7 yards will cost 7 times as much, which is \$42.00, the answer as before.

3. If 3 men drink a barrel of cider in 24 days, how long would it take 9 men ? Ans. 8 ds.

Mn. m. ds.

9 : 3 :: 24

3

9)72

8ds.

As the answer is to be in days, we make 24 days the third term, and because 9 men will drink the cider in less time than 3 men, the second term will be less than the first.

To perform this question *analytically*, we would say, that if 3 men drink a barrel of cider in 24 days, it would take one man 3 times 24 days, which is 72 days; and if one man drink a barrel of cider in 72 days, 9 men would drink it in $\frac{1}{3}$ of 72 days, which is 8 days, as before.

NOTE.—Questions of this kind were formerly performed by the Rule of Three Inverse, when more required less, and less required more.

4. If 12 yards of cloth cost \$48, what will 15 yards cost ?

Ans. \$60.00,

5. If 17 lbs. of sugar cost \$1.19, what will 365 lbs. cost ?

Ans. \$25.55.

6. If 16 acres of land cost \$720, what will 197 acres cost ?

Ans. \$8865.00.

7. If \$8865 buy 197 acres, how many acres may be bought for \$720 ?

Ans. 16 acres.

8. What will 84 hhds. of molasses cost if 15 hhds. can be purchased for \$175.95 ?

Ans. \$925.32.

9. If \$100 gain \$6 in 12 months, how much would it gain in 40 months ?

Ans. \$20.00.

10. If a certain vessel has provisions sufficient to last a crew of 10 men 45 days, how long would the provisions last if the vessel were to ship 5 new hands ?

Ans. 30 ds.

11. If 7 and 9 were 12, what on the same supposition would 8 and 4 be ?

Ans. 9.

12. If 9 men can perform a certain piece of labor in 17 days, how long would it take three men ? Ans. 51 ds.
13. If 3 men can perform a piece of labor in 51 days, how many must be added to the number to perform the labor in 17 days ? Ans. 6 m.
14. How much in length, that is $5\frac{1}{2}$ rods in breadth, is sufficient for an acre ? Ans. $29\frac{1}{4}$ rods.
15. If 2 barrels of flower cost \$12.00, what will 24 barrels cost ? Ans. \$144.00.
16. If 5 quintals of fish cost \$16.25, what is the value of 75 quintals ? Ans. \$243.75.
17. If 2 cords of wood cost \$11.50, what will 17 cords cost ? Ans. \$97.75.
18. If 7 cwt. of iron cost \$56.85, what will 49 cwt. cost ? Ans. \$397.95.
19. If 5 acres of land be valued at \$375.75, what would be the cost of 35 acres ? Ans. \$2630.25.
20. If 7 pair of shoes cost \$10.50, how many pair will \$52.50 buy ? Ans. 35 pair.
21. If \$4.75 are paid for 19 lbs. of salmon, how many pounds will \$25.50 buy ? Ans. 102 lbs.
22. If a man travels 48 miles in 6 hours, how far will he travel in 24 hours ? Ans. 192 m.
23. If 8 men drink a barrel of cider in 24 days, how long would it last 3 men ? Ans. 64 ds.
24. If 7 ounces of silver is sufficient to make 17 tea spoons, how many may be made from 42 ounces ? Ans. 102 spoons.
25. If \$100 gain \$6 in a year, how much will \$850 gain ? Ans. \$51.00.
26. If \$100 gain \$6 in a year, how much would be sufficient to gain \$32 in a year ? Ans. \$533.33 $\frac{1}{3}$.
27. If 20 gallons of water weigh 167 lbs. what will 180 gallons weigh ? Ans. 1503 lbs.
28. If a staff 3 feet long, cast a shadow 2 feet, how high is that steeple whose shadow is 75 feet ? Ans. $112\frac{1}{2}$ feet.
29. If $5\frac{1}{2}$ cwt. be carried 36 miles for \$4.75, how far might it be carried for \$160 ? Ans. $1212\frac{1}{2}$ m.
30. If 100 workmen, can finish a piece of work in 12 days, how many men are sufficient to finish the work in 8 days ? Ans. 150 men.

31. If $\frac{1}{12}$ of a yard cost $\frac{7}{10}$ of a dollar, what will $\frac{4}{5}$ of a yard cost ?

Ans. \$0.48.

Yd. yd. \$

$$\frac{1}{12} : \frac{4}{5} :: \frac{7}{10} \quad \text{Ans. } \frac{1}{12} \times \frac{4}{5} \times \frac{7}{10} = \frac{28}{750} = \frac{14}{375} = \$0.48$$

To perform this question by analysis, we would proceed thus, and say, if $\frac{1}{12}$ of a yard cost $\frac{7}{10}$ of a dollar, $\frac{1}{12}$ would cost $\frac{1}{4}$ of $\frac{7}{10}$, which is $\frac{7}{40}$; and if $\frac{1}{12}$ cost $\frac{7}{40}$, $\frac{4}{5}$ will cost 12 times $\frac{7}{40}$, which is $\frac{14}{5} = \frac{2}{5}$ of a dollar. And if one yard cost $\frac{2}{5}$ of a dollar, $\frac{4}{5}$ of a yard will cost $\frac{4}{5}$ of a dollar, and $\frac{4}{5}$ will cost 4 times as much, that is, it will cost 4 times $\frac{4}{5}$, which is $\frac{16}{5} = \$0.48$, as before.

32. If $\frac{1}{2}$ of a yard cost $\frac{3}{5}$ of a £, what will $\frac{7}{8}$ of a yard cost ?

Ans. 14 shillings.

33. If $4\frac{1}{2}$ yards cost \$9.75, what will $13\frac{1}{2}$ yards cost ?

Ans. \$29.25.

34. How much in length that is $2\frac{1}{2}$ inches wide will make a square foot ?

Ans. $57\frac{3}{4}$ inches.

35. If $\frac{7}{16}$ of a ship cost £51, what are $\frac{3}{32}$ of her worth ?

Ans. 10£ 18s. 6½d.

36. A merchant bought a number of pieces of velvet, each containing $129\frac{1}{2}$ yards, at the rate of \$7 pr. 5 yards, and sold them out again at the rate of \$11 pr. 7 yards, and gained \$200 by the bargain; how many bales were there ?

Ans. 9 bales.

37. If the moon moves $13^{\circ} 10' 35''$ in one day, in what time does he perform one revolution ?

Ans. 27ds. 7h. 43m.

38. If 7 lbs. of sugar cost $\frac{3}{4}$ of a dollar, what is 12 lbs. worth ?

Ans. \$1.284.

39. If \$1.75 will buy 7 lbs. of loaf sugar, how much will \$213.50 buy ?

Ans. 7cwt. 2qrs. 14lbs.

40. If 7 ounces of gold is worth £30, what is the value of 7lbs. 11oz. ?

Ans. 407£ 2s. 10½.

41. My friend borrowed of me \$500 for 6 months, promising me like favor; soon after I had occasion for \$600; how long should I keep it to receive full compensation for the kindness ?

Ans. 5 months.

42. If the penny loaf weighs 7oz. when flour is \$8 per barrel, how much should it weigh when flour is \$7.50.

Ans. $7\frac{1}{5}$ ounces.

43. If a regiment of soldiers consisting of 1000 men, were to be clothed, each suit containing $3\frac{1}{2}$ yards of cloth, that is

$1\frac{1}{2}$ yard wide, and to be lined with flannel $1\frac{1}{2}$ yard wide, how many yards will it take to line the whole? Ans. 5625 yds.

44. If $9\frac{1}{2}$ yards of broadcloth cost $\$11\frac{1}{2}$, what will $13\frac{1}{2}$ ells English cost? Ans. $\$24$.

45. A merchant failing in trade, owes in all $\$17.280$; his effects are sold for $\$16.120$. What does he pay on a dollar; and what does A receive, to whom he owes $\$5.670$?

Ans. he pays $\$0.87\frac{1}{4}$ on the dollar.

A receives $\$4961.25$.

46. Bought in London 57 yards of broadcloth for 49 guineas, 28 shillings each, what did it cost per ell English.

Ans. $1\text{£ } 10\text{s. } 1\text{r. } 6\text{d.}$

47. Bought a cask of wine at $\$1.15$ per gallon, for $\$100$; how much did it contain? Ans. 86 gal. 3 qts. $1\frac{1}{4}$ pts.

48. A merchant bought 9 packages of cloth for $\$345.60$, each package containing 8 parcels, each parcel 12 pieces, and each piece 20 yards; what was the price per yard?

Ans. $\$2.00$.

49. If 75 gallons of water fall into a cistern containing 500 gallons, and by a pipe in the cistern 40 gallons run out in an hour; in what time will it be filled? Ans. 14h. 17m. $8\frac{1}{2}$ sec.

50. How many dozen pair of gloves, at $\$0.56$ per pair, may be bought for $\$120.96$?

Ans. 18 doz.

51. A certain cistern has three pipes, the first will empty it in 20 minutes, the second in 40 minutes, and the third in 75 minutes; in what time would they all empty it?

Ans. 11 m. $19\frac{1}{3}$ sec.

52. A can mow a certain field in 5 days, and B can mow it in 6 days; in what time would they both mow it?

Ans. $2\frac{2}{11}$ ds.

53. A wall which was to be built 32 feet high, was raised 8 feet by 6 men in 12 days; how many men must be employed to finish the wall in 6 days?

Ans. 36 men.

54. A can build a boat in 20 days, but with the assistance of C, he can do it 12 days; in what time would C do it himself?

Ans. 30 ds.

55. In a fort there are 700 men, provided with 184000 lbs. of provisions, of which they consume each man 5 lbs. a week; how long can they subsist?

Ans. 52 weeks, 4 ds.

56. If 25 men have $\frac{3}{4}$ of a pound of beef, each three times in a week, how long will 3150 lbs. last them?

Ans. 56 weeks.

57. How many tiles 8 inches square, will lay a floor 20 feet long and 16 feet wide ?

Ans. 720.

58. How many stones 10 inches long, 9 inches broad, and 4 inches thick, would it take to build a wall 80 feet long, 20 feet high and $2\frac{1}{4}$ feet thick.

Ans. 17280 stones.

59. Bought 3 score pieces of Holland for three times as many dollars, and sold them again for four times as many dollars; but if they had cost me as much as I sold them for, for what should I have sold them to gain after the same rate ?

Ans. \$320.

60. A sets out on a journey and travels 27 miles a day; 7 days after, B sets out and travels the same road 36 miles a day; in how many days will B overtake A ?

Ans. 21 ds.

61. If I sell coffee at 2s. 3d. per lb. and gain 35 per cent., what did I give per lb. ?

Ans. 20d.

62. Suppose 2000 soldiers had been supplied with bread, sufficient to last them 12 weeks, allowing each man 14 ounces a day, but, on examining, find 105 barrels, containing 200 lbs. each, wholly spoiled; how much a day may each man eat, that the remainder may supply them 12 weeks ?

Ans. 12 ounces.

63. If 2000 soldiers were put on an allowance of 12 ounces of bread per day, for 12 weeks; having a seventh part of their bread spoiled; what was the whole weight of their bread, (good and bad,) and how much was spoiled ?

The whole, 147000 lbs.

Spoiled, 21000 lbs.

64. If 2000 soldiers, having lost 105 barrels of bread, weighing 200 lbs. each, were obliged to subsist on 12 ounces a day for 12 weeks. But had none been lost, they might have had 14 ounces a day, the same time. What was the whole weight, including what was lost; and how much had they left to subsist on ?

The whole weight, 147000 lbs.

Left to subsist on, 126000 lbs.

65. If 2000 soldiers, after losing one seventh part of their bread, had each 12 ounces a day, for 12 weeks, what was the whole weight of their bread, including that lost, and how

much might they have had per day, each man, if none had been lost?

The weight was 147000 lbs.

The loss, 21000 lbs.

Had none been lost, they might have had 14 ounces per day.

66. If .85 of a gallon of wine cost \$2.72, how much will .25 of a gallon cost?

Ans. \$0.80.

67. If 61.3 pounds of tea cost \$44.9942, what is the price per lb.?

Ans. \$0.734.

68. What is the value of .15 of a hogshead of lime, at \$2.39 per hhd.?

Ans. \$0.3585.

69. If .75 of a ton of hay cost \$15, what is it per ton?

Ans. \$20.00.

70. How many yards of carpeting that is half a yard wide, will cover a room that is 30 feet long and 18 feet wide?

Ans. 120 yards.

71. If a man perform a journey in 15 days, when the day is 12 hours long, in how many will he do it when the day is but 10 hours?

Ans. 18 days.

72. If 450 men are in a garrison, and their provisions will last them but 5 months; how many must leave the garrison that the same provisions may be sufficient for them who remain 9 months?

Ans. 200 men.

73. The hour and minute hand of a watch are together at 12 o'clock, when are they next together?

Ans. 1 h. 5 m. $27\frac{3}{11}$ sec.

74. A and B can perform a piece of work in $5\frac{1}{11}$ days, B and C in $6\frac{1}{3}$ days; and A and C in 6 days. In what time would each of them perform the work alone, and how long would it take them to do the work together?

A would do the work in 10 days,

B would do the work in 12 days,

C would do the work in 15 days,

A, B and C, together in 4 days.

COMPOUND PROPORTION,

OR

DOUBLE RULE OF THREE.

Compound Proportion is the method of performing such operations in Proportion, as require two or more statements.

RULE.

Make that number, which is of the same kind as the answer required, the third term; and, of the remaining numbers, take any two, that are of the same kind, placing the greater or less first, according as the third is greater or less than the term sought, and so on, until all are used.

The following examples will illustrate the principles of this rule.

1. If a man travel 117 miles in 30 days, employing only 9 hours a day, how far would he go in 20 days, travelling 12 hours a day?

Then the distance to be travelled depends on two circumstances—the number of days the men travel, and the number of hours he travels in each day.

We will first suppose the hours to be the same in each case; the question will then be,—If a man travel 117 miles in 30 days, how far will he travel in 20 days?

This will lead to the following proportion.

$$30 \text{ days} : 20 \text{ days} :: 117 \text{ miles} : 117 \frac{20}{30} = 78 \text{ miles.}$$

That is, if we multiply 117 by 20, and divide by 30, we obtain the number of miles he will travel in 20 days, which is 78.

Now, if we take into consideration the number of hours, we must say,—If a man, travelling 9 hours a day for a certain number of days, has travelled 78 miles, how far will he go in the same time, if he travel 12 hours a day? This will furnish the following proportion.

9 hours : 12 hours :: 78 miles : $12\frac{27}{8}=104$ miles, the answer to the question.

By this mode of revolving the question, we see that 117 miles has, to the answer 104 miles, the proportion that 30 days has to 20 days, and that 9 hours has to 12 hours. Stating this in compound proportion, we have

$$\begin{array}{l} 30 : 20 \} \\ 9 : 12 \} \end{array} :: 117 : 104 \text{ miles, the answer.}$$

Thus it appears, that if 117 be multiplied by both 20 and 12, and the product be divided by 30 times 9, the quotient will be 104 miles; or if we multiply 117 by 20, and divide the product by 30, and then multiply this quotient by 12 and divide by 9, it will produce the same answer as before.

This question may be performed by analysis, thus. If he travel 117 miles in 30 days, in one day he will travel $\frac{1}{30}$ of 117 miles, which is $\frac{117}{30}$ miles; and, travelling 9 hours a day, he will in one hour travel $\frac{1}{9}$ of $\frac{117}{30}$ miles; which is $\frac{117}{270}$ miles; and in a day of 12 hours, he will travel 12 times $\frac{117}{270}$ miles, which is $\frac{117}{22.5}$ miles; and in 20 days he will travel 20 times $\frac{117}{22.5}$ miles, which is 104 miles, the answer as before.

The answer to the above question might have been obtained by multiplying the third term by the ratios, which the two first terms have to the second terms; that is, by the ratio of 30 to 20, which is $\frac{3}{2}$; and of 9 to 12, which is $\frac{2}{3}$. Thus $117 \times \frac{3}{2} \times \frac{2}{3} = 104$, the answer.

2. If 6 men, in 16 days, of 8 hours each, build a wall 20 feet long, 6 feet high, and 4 feet thick, in how many days of 9 hours each, will 24 men build a wall 200 feet long, 8 feet high, and 6 feet thick?

In stating this question, there are several circumstances to be taken into consideration: the number of men employed, the length of the days, length of the wall, and its height and breadth.

As the answer to the question is to be in days, we make the days the third term.

Were all the circumstances of the question alike, except the

number of men and the number of days, the question would consist in finding in how many days 24 men would perform the same labor, that 6 men had done in 16 days; that is, if 6 men had built a certain wall in 16 days, how many days would it take 24 men to perform the same labor. This would furnish the following proportion.

$$24 \text{ men} : 6 \text{ men} :: 16 \text{ days} : 6 \frac{2}{3} = 4 \text{ days.}$$

Or, if this were the question. If a certain number of men, by laboring 9 hours a day, perform a piece of work in 16 days, how many days would it take the same men to do the labor, by working 8 hours a day? The following would be the proportion.

$$8 \text{ hours} : 9 \text{ hours} :: 16 \text{ days} : 9 \frac{1}{8} = 18 \text{ days.}$$

Or, if this were the question. If a certain number of men build a wall 20 feet long in 16 days, how long would it take the same men to build a wall 200 feet long; the following would be the statement.

$$20 \text{ feet} : 200 \text{ feet} :: 16 \text{ days} : 16 \frac{2}{3} \times 10 = 160 \text{ days.}$$

Or, if only the days and height of the wall were considered, this would be the statement.

$$6 \text{ feet} : 8 \text{ feet} :: 16 \text{ days} : 8 \frac{1}{6} = 21 \frac{1}{3} \text{ days.}$$

Lastly, were we to consider only the days and the thickness of the wall, it would furnish the following statement.

$$4 \text{ feet} : 6 \text{ feet} :: 16 \text{ days} : 6 \frac{2}{4} = 24 \text{ days.}$$

We see, by this mode of resolving the question, that 16 days must have, to the *true answer*, the ratio compounded of the ratios,

That 24 men has to 6 men;
That 8 hours has to 9 hours;
That 20 feet has to 200 feet;
That 6 feet has to 8 feet, and
That 4 feet has to 6 feet.

Stating the above in Compound Proportion, we have

$$\left. \begin{array}{l} 24 \text{ men} : 6 \text{ men} \\ 8 \text{ hours} : 9 \text{ hours} \\ 20 \text{ feet} : 200 \text{ feet} \\ 6 \text{ feet} : 8 \text{ feet} \\ 4 \text{ feet} : 6 \text{ feet} \end{array} \right\} :: 16 \text{ days} : 90 \text{ days} = \text{Answer.}$$

The continued product of all the second term by the third term, and this divided by the continued of the first term, will produce the answer.

Thus $\frac{3}{4} \times \frac{9}{8} \times \frac{200}{20} \times \frac{8}{8} \times \frac{6}{4} \times \frac{16}{16} = \frac{82240}{90} = 90 \text{ days} = \text{Answer.}$

3. If \$100 gain \$6 in one year, how much would \$500 gain in 4 months? Ans. \$10.

4. If \$100 gain \$6 in one year, what must be the sum to gain \$10 in 4 months? Ans. \$500.

5. How long will it take \$500 to gain \$10, if \$100 gain \$6 in one year? Ans. 4 months.

6. If \$500 gain \$10 in 4 months, what is the rate per cent.? Ans. 6 per cent.

7. If 8 men spend \$32 in 13 weeks, what will 24 men spend in 52 weeks? Ans. \$384.

8. If 12 men, in 15 days, can build a wall 30 feet long, 6 feet high, and 3 feet thick, when the days are 12 hours long; in what time will 60 men build a wall 300 feet long, 8 feet high, and 6 feet thick, when they work only 8 hours a day?

Ans. 120 days.

9. If 16 horses consume 84 bushels of grain in 24 days, how many bushels will suffice 32 horses 48 days?

Ans. 336 bushels.

10. If the carriage of 5 cwt. 3 qrs., 150 miles, cost \$24.58, what must be paid for the carriage of 7 cwt. 2 qrs. 25 lbs., 64 miles, at the same rate?

Ans. \$14.08.6

11. If 7 oz. 5 dwt. of bread be bought at 4½d., when corn is 4s. 2d. per bushel, what weight of it may be bought for 1s. 2d. when the price per bushel is 5s. 6d.?

Ans. 1 lb. 4 oz. 3½ dwt.

CHAIN RULE.

The *chain rule* consists in joining many proportions together; and by the relation which the several antecedents have to their consequents, the proportion between the first antecedent and the last consequent is discovered.

This rule may often be abridged by cancelling equal quantities on both sides, and abbreviating commensurables.

NOTE.—The first numbers in each part of the question are called *antecedents*, and the following *consequents*.

RULE.

Place the numbers alternately, that is, the antecedents at the left hand, and the consequents at the right, and let the last number stand on the left hand; then multiply the left hand column continually for a dividend, and the right hand for a divisor, and the quotient will be the answer.

NOTE.—The demonstration for this rule is the same as for Compound Proportion.

EXAMPLES.

1. If 20 lbs. at Boston make 23 lbs. at Antwerp, and 155 lbs. at Antwerp make 180 at Leghorn, how many pounds at Boston are equal to 144 lbs. at Leghorn?

20 lbs. of Boston=23 of Antwerp,
155 lbs. of Antwerp=180 of Leghorn,
144 lbs. of Leghorn.

$$20 \times 155 \times 144 = 46400 = 107 \frac{1}{2} \text{ Answer.}$$

2. If 12 lbs. at Boston make 10 lbs. at Amsterdam, and 10 lbs. at Amsterdam make 12 lbs. at Paris, how many pounds at Boston are equal to 80 lbs. at Paris? Ans. 80 lbs.

3. If 25 lbs. at Boston are equal to 22 lbs. at Nuremburg, and 88 lbs. at Nuremburg are equal to 92 lbs. at Hamburg, and 46 lbs. at Hamburg are equal to 49 lbs. at Lyons, how many pounds at Boston are equal to 98 lbs. of Lyons?

Ans. 100 lbs.

4. If 24 shillings in Massachusetts are equal to 32 shillings in New York; and if 48 shillings in New York are equal to 45 shillings in Pennsylvania; and if 15 shillings in Pennsylvania are equal to 10 shillings in Canada; how many shillings in Canada are equal to 100 shillings in Massachusetts?

Ans. 83 $\frac{1}{2}$ shillings.

5. If 17 men can do as much work as 25 women, and 5 women do as much as 7 boys, how many men would it take to do the work of 75 boys?

Ans. 37 men.

6. If 10 barrels of cider will pay for 5 cords of wood, and 20 cords of wood for 4 tons of hay, how many barrels of cider will it take to purchase 50 tons of hay? Ans. 500 bbls.

7. If 100 acres in Bradford be worth 120 in Haverhill, and 50 in Haverhill worth 65 in Methuen, how many acres in Bradford are equal to 150 in Methuen? Ans. $96\frac{2}{3}$ acres.

8. If 10 pounds of cheese are equal in value to 7 lbs. of butter, and 11 lbs. of butter to 2 bushels of corn, and 11 bushels of corn to 8 bushels of rye, and 4 bushels of rye to one cord of wood, how many pounds of cheese are equal in value to 10 cords of wood? Ans. 432 $\frac{1}{2}$ lbs.

FELLOWSHIP.

Fellowship is a rule by which merchants, and others in partnership, estimate their gain or loss in trade. It is of two kinds, single and double.

Single Fellowship is, when merchants in partnership employ their stock for *equal times*.

NOTE.—Partnership is the union of two or more in the same trade.

RULE.

As the whole stock in trade is to the whole gain or loss, so is each man's stock in trade to each man's gain or loss.

EXAMPLES.

1. Three men, A, B and C, enter into partnership for two years, with a capital of \$1080. A put in \$240; B \$360; and C \$480. They gain \$54. What is each man's share of the gain?

$$\begin{array}{r}
 \$ \quad \$ \quad \$ \\
 1080 : 54 :: 240 \\
 \underline{240} \\
 2160 \\
 108
 \end{array}$$

$$\begin{array}{r}
 1080)12960(12=A's \text{ gain.} \\
 \underline{1080} \\
 2160 \\
 2160
 \end{array}$$

$$\begin{array}{r}
 \$ \quad \$ \quad \$ \\
 1080 : 54 :: 360 \\
 \underline{360} \\
 3240 \\
 162
 \end{array}$$

$$\begin{array}{r}
 1080)19440(18=B's \text{ gain} \\
 \underline{1080} \\
 8640 \\
 8640
 \end{array}$$

$$\begin{array}{r}
 \$ \quad \$ \quad \$ \\
 1080 : 54 :: 480 \\
 \underline{480}
 \end{array}$$

$$\begin{array}{r}
 4320 \\
 216 \\
 \underline{\quad} \\
 1080)25920(24=C's \text{ gain.} \\
 \underline{2160} \\
 4320 \\
 4320
 \end{array}$$

A's gain, \$12
 B's gain, \$18
 C's gain, \$24

Proof, \$54

The same by *analysis*.

The whole stock in trade was \$1080, of which \$240 belonged to A. Therefore A's share of the stock was $\frac{240}{1080} = \frac{2}{9}$; and as each man's gain was in proportion to his stock, $\frac{2}{9}$ of \$54, which is \$12, was A's gain. B's stock in trade was \$360, therefore $\frac{360}{1080} = \frac{1}{3}$ was his share of the whole stock; consequently $\frac{1}{3}$ of \$54=\$18 was B's gain. C's stock was \$480, therefore his part of the whole stock was $\frac{480}{1080} = \frac{4}{9}$; consequently his gain was $\frac{4}{9}$ of \$54=\$24, C's gain, as before.

2. A, B, and C, enter into partnership with a capital of \$1100, of which A put in \$250, B put in \$300, and C \$550; they lost by trading 5 per cent. on their capital. What was each man's share of the loss?

A's loss, \$12.50,
 B's loss, \$15.00,
 C's loss, \$27.50.

3. Two merchants, C and D, engaged in trade; C put in \$6780, D put in \$12000; they gain \$1000. What is each man's share?

C's share, \$361.02.2 $\frac{1}{4}$;

D's share, \$638.97.7 $\frac{1}{4}$.

4. M, P, Q, trade in company with a capital of \$10.000; M put in \$3000, P \$2000, and Q \$5000; they gain \$500. What is each man's share of the gain?

M's gain, \$150,

P's gain, \$100,

Q's gain, \$250.

5. A, B, and C, enter into partnership; A put in \$500, B \$350, and C put in 320 yards of broadcloth; they gain \$332.50, of which C's share is \$120. What was A's and B's shares of the gain, and the value of C's cloth per yard?

A's gain, \$12500,

B's gain, \$87.50,

C's cloth per yd. \$5.00.

6. A, B, and C, trade in company; A put in \$5000, B put in \$6500, and C put in \$7500; they gain 40 per cent. on their capital, but receive the whole amount of their goods in bills, for which they are obliged to allow a discount of 10 per cent. How much was each man's net gain?

A's gain, \$1800,

B's gain, \$2340,

C's gain, \$2700.

7. A merchant failing in trade, owes A \$600, B \$760, C \$840, D \$800. His effects are sold for \$2275. What will each receive of the dividend?

A, \$455.00

B, \$576.33 $\frac{1}{3}$

C, \$637.00

D, \$606.66 $\frac{2}{3}$

8. A bankrupt owes \$5000. His effects, sold at auction, amount to \$4000. What will his creditors receive on a dollar?

Ans. \$0.80.

9. A merchant, having sustained many losses, is obliged to become a bankrupt. His effects are valued at \$1728, with which he can pay only fifteen cents on the dollar. What did he owe?

Ans. \$11520.

DOUBLE FELLOWSHIP.

When merchants in partnership employ the stock for unequal times, it is called Double Fellowship.

RULE.

Multiply each man's stock by the time it was continued in trade; then as the sum of all the products, is to the whole gain or loss; so is each man's particular product, to his particular share of the gain or loss.

EXAMPLES.

1. Two men, A and B, traded in company; A put in \$450 for 5 months, and B put in \$350 for 8 months; they gained \$85. What was each man's share of the gain?

| | |
|---|--|
| $ \begin{array}{r} 420 \times 5 = 2100 \\ 350 \times 8 = 3000 \\ \hline 5100 \\ 5100 : 85 :: 3000 \\ \hline 85 \\ 15000 \\ 24000 \\ \hline 5100)255000(50 \text{ B's gain.} \\ 25500 \end{array} $ | $ \begin{array}{r} 5100 : 85 :: 2100 \\ \hline 85 \\ 10500 \\ 16800 \\ \hline 5100)178500(35 \text{ A's gain.} \\ 15300 \\ \hline 25500 \\ 25500 \\ \hline \text{A's gain, } \$35 \\ \text{B's gain, } \$50 \\ \hline \text{Proof, } \$85 \end{array} $ |
|---|--|

The same by analysis.

\$450 for 5 months, is the same as $5 \times \$420 = \2100 , for 1 month; and \$350 for 8 months, is the same as $8 \times \$350 = \3000 for 1 month; the question therefore is the same, as if A had put in \$2100, and B \$3000. The whole stock would then be \$5100. A's share of the gain therefore will be $\frac{2100}{5100} = \frac{7}{17}$ of \$85 = \$35; and B's share will be $\frac{3000}{5100} = \frac{10}{17}$ of \$85 = \$50, as before.

2. A commenced business Jan. 1, with a capital of \$3200. May 1, he took B into partnership with a capital of \$4200; and at the end of the year they had gained \$240. What was each man's share of the gain?

\$128, A's gain,
\$112, B's gain.

3. A, B, and C, traded in company. A put in \$300 for 5 months, B put in \$400 for 8 months, and C put in \$500 for 3 months; they gain \$100. What is the gain of each?

\$24.19 $\frac{1}{3}$, A's gain,
\$51.61 $\frac{2}{3}$, B's gain,
\$24.19 $\frac{1}{3}$, C's gain.

4. Three men hire a pasture in common; for which they are to pay \$26.40. A put in 24 oxen for 8 weeks; B put in 18 oxen for 12 weeks; and C put in 12 oxen for 10 weeks. What ought each to pay?

A should pay \$9.60,
B should pay \$10.80,
C should pay \$6.00.

5. Two men in Boston hire a carriage for \$25, to go to Concord, N. H., the distance being 72 miles, with the privilege of taking in three more persons. Having gone 20 miles, they take in A; at Concord they take in B; and when within 30 miles of the city, they take in C. How much shall each man pay?

First man pays \$7.60.91 $\frac{1}{3}$,
Second man pays \$7.60.91 $\frac{1}{3}$,
A pays \$5.87.31 $\frac{1}{3}$,
B pays \$2.86.41 $\frac{1}{2}$,
C pays \$1.04.11 $\frac{1}{2}$.

\$25.00.0.

6. Three men engage in partnership for 20 months. A at first put into the firm \$4000; and at the end of 4 months, he put in \$500 more, but at the end of 16 months, he took out \$1000. B at first put in \$3000, but at the end of 10 months, he took out \$1500, and at the end of 14 months he put in

\$3000; C at first put in \$2000, and at the end of 6 months, he put in \$2000 more, and at the end of 14 months he put in \$2000 more, but at the end of 16 months, he took out \$1500; they had gained by trade \$4420. What is each man's share of the gain?

A's gain, \$1680,

B's gain, \$1260,

C's gain, \$1480.

7. John Jones, Samuel Eaton, and Joseph Brown, formed a partnership under the firm of Jones, Eaton & Co., with a capital of \$10,000; of which Jones put in \$4000, Eaton put in \$3500, and Brown put in \$2500; but at the end of 6 months Jones withdrew \$2000 of his stock; and at the end of 8 months Eaton withdrew \$1500 from the firm; but at the end of 10 months Brown added \$2000 to his stock. At the end of 2 years they found their gains to be \$1041.80. What was the share of each man?

A's gain, \$312.54,

B's gain, \$270.86.8,

C's gain, \$458.39.2.

DISCOUNT.

The object of Discount is to show us what allowance should be made, when any sum of money is paid before it becomes due.

The *present worth* of any sum is the principal, that must be put at interest to amount to that sum in the given time. That is, \$100 is the *present worth* of \$106, due one year hence; because \$100 at 6 per cent. will amount to \$106, and \$6 is the *discount*.

RULE.

To find the present worth, say as the amount of \$100, for the given rate and time, is to \$100, so is the given sum to the present worth. Or, divide the given sum by the amount of \$1.00 for the given rate and time, and the quotient is the *present worth*.

Subtract the present worth from the given sum, and the remainder is the *discount*.

EXAMPLES.

1. What is the present worth of \$12.72, due one year hence?

First method.

$$\begin{array}{r} \$ \quad \$ \quad \$ \\ 106 : 100 :: 12.72 \\ \quad \quad 100 \end{array}$$

$$\begin{array}{r} 106)1272.00(\$12. \\ \underline{106} \\ 212 \\ \underline{212} \\ 212 \end{array}$$

Second method.

$$\begin{array}{r} 1.06)12.72(\$12. \\ \underline{106} \end{array}$$

$$\begin{array}{r} 212 \\ \underline{212} \end{array}$$

NOTE.—As \$100 will amount to \$106 in one year, at 6 per cent. it is evident, that, if $\frac{100}{106}$ of any sum be taken, it will be the present worth for that time, and that $\frac{6}{106}$ will be the discount.

2. What is the present worth of \$117.60, due one year hence, at 12 per cent.?

Ans. \$105.00.

3. What is the discount of \$802.50, at 7 per cent. due one year hence?

Ans. \$52.50.

4. What is the present worth of \$769.60, due 3 years and 5 months hence?

Ans. \$638.67 $\frac{2}{3}$ $\frac{1}{4}$ r.

5. What is the present worth of \$986.40, due 7 years, 9 months and 20 days hence?

Ans. \$671.78 $\frac{2}{3}$ $\frac{5}{8}$ r.

6. How much grain must be sent to the miller, that a bushel of meal may be returned; the miller taking $\frac{1}{8}$ part for toll?

Ans. $34\frac{2}{5}$ quarts.

7. What is the present worth of \$678.75, due 3 years, 7 months hence, at $7\frac{1}{2}$ per cent.?

Ans. \$534.97 $\frac{5}{8}$ $\frac{1}{4}$ r.

8. I have given my note for \$1000, to be paid Dec. 18, 1835. What is the note worth June 7, 1834?

Ans. \$915.89 $\frac{4}{5}$ $\frac{1}{4}$ r.

9. James has a note against Samuel for \$715.50, dated Aug. 17, 1834, which becomes due, January 11, 1835. What ready money will pay the note Sept. 25, 1834?

Ans. \$703.085+

10. A has B's note, which becomes due Nov. 25, 1835, for \$914.75. What is this note worth January 1, 1835?

Ans. \$867.884+

11. A merchant has given two notes; the first for \$79.87, to be paid January 21, 1836; the second for \$87.75, to be paid Dec. 17, 1836. What ready money will discharge both notes Feb. 10, 1835? Ans. \$154.54.5.

12. It being now Oct. 14, 1833, and A owing me \$1728, to be paid Dec. 17, 1837; what ought I now to receive as an equivalent? Ans. \$1381.84.7²/₅01.

13. Bought cloth in Boston at \$5.00 per yard. What must be my "asking price," in order that I may fall on it 10 per cent. and still make 10 per cent. on my purchase?

Ans. \$6.11¹/₂.

14. James Ober owes Samuel Hall as follows: \$365.87, to be paid Dec. 19, 1835; \$161.15, to be paid July 16, 1836; \$112.50, to be paid June 23, 1834; \$96.81, to be paid April 19, 1838. What should he receive as an equivalent, Jan. 1, 1834? Ans. \$653.40.+

15. A B, of Bradford, has sent shoes at several different times to Spofford and Tileston, New York, as follows.

| | | |
|-------------------|-------------------------------------|-----------|
| January 16, 1834, | were received shoes to the value of | \$865.00. |
| Feb. 17, 1834, | " | 396.27. |
| March 29, 1834, | " | 769.25. |
| May 25, 1834, | " | 183.75. |
| June 19, 1834, | " | 396.81. |

The above were sold on 6 months' credit.

A B has received of Spofford and Tileston, as follows: September 1, 1834, \$1000; Oct. 19, 1834, \$375.25; Nov. 15, 1834, \$681.29; Dec. 8, 1834, \$100; March 12, 1835, \$275.28. Required the balance of the amount at the time of settlement, Sep. 9, 1835.

Ans. Spofford and Tileston owe to A B, \$168.50.9.

METHOD OF ASSESSING TOWN, STATE AND COUNTY TAXES.

RULE I.

First. Say, as the whole amount of the State Tax, which the Town has to pay the State, is to the poll tax, which each

individual pays the State; so is the whole amount of the town, state, and county taxes, which the town has to raise, to the poll tax, which is to be assessed on each individual; then multiply this poll tax by the number of polls in the town, subtract this product from the amount of all the taxes, and note the remainder; then say, as the valuation of the town is to this remainder, so is one dollar to the sum, that must be assessed on the dollar.

EXAMPLES.

1. Suppose the State Treasurer sends to the town of A, that their proportion of the State tax of \$75.000, is \$277.20, of which the polls are to pay 11 cents each, and the remainder to be assessed equally on the estates, real and personal. The county tax required is \$554.40, and the town vote to raise \$1940.40, to defray town charges. The valuation of the town is \$154.000, and it contains 420 polls. What will be B's tax, who stands in the valuation as follows: real estate, \$3678; Personal estate, \$526; and 3 polls?

OPERATION.

| | |
|-------------------------------|----------------------|
| 277.20 | 420 number of polls. |
| 554.40 | 1.10 |
| 1940.40 | |
| \$277.20 : 11 cts. :: 2772.00 | 462.00 |
| .11 | |

277.20)3049200(\$1.10 Poll tax.

| | |
|-------|-----------|
| 27720 | |
| 27720 | \$2772.00 |
| 27720 | 462.00 |
| | 2310.00 |

\$154000 : \$231000 :: \$1.

1

c. m.

154000)231000 (.015 to be assessed on the dollar.

154000
770000
770000

TABLE.

| | \$10000 | \$1000 | \$100 | \$10 | \$1. | 10 cts. | 1 ct. |
|---|---------|--------|-------|------|------|---------|-------|
| 1 | 150. | 15. | 1.50 | .15 | .015 | .0015 | .0001 |
| 2 | 300. | 30. | 3.00 | .30 | .030 | .0030 | .0003 |
| 3 | 450. | 45. | 4.50 | .45 | .045 | .0045 | .0004 |
| 4 | 600. | 60. | 6.00 | .60 | .060 | .0060 | .0006 |
| 5 | 750. | 75. | 7.50 | .75 | .075 | .0075 | .0007 |
| 6 | 900. | 90. | 9.00 | .90 | .090 | .0090 | .0009 |
| 7 | 1050. | 105. | 10.50 | 1.05 | .105 | .0105 | .0010 |
| 8 | 1200. | 120. | 12.00 | 1.20 | .120 | .0120 | .0012 |
| 9 | 1350. | 135. | 13.50 | 1.35 | .135 | .0135 | .0013 |

Now to know the amount of B's taxes, his real estate being \$3678, I find by the table, that

| | |
|-------------------|---------|
| \$3000 pays . . . | \$45.00 |
| \$600 pays . . . | \$9.00 |
| \$70 pays . . . | \$1.05 |
| \$8 pays . . . | .12 |
| | <hr/> |
| | \$55.17 |

His personal estate being \$526, it is found by the table, that

| | |
|--------------------------------|---------|
| \$500 pays . . . | \$7.50 |
| \$20 pays . . . | .30 |
| \$6 pays . . . | 9 |
| | <hr/> |
| \$526 | \$7.89 |
| Three polls at \$1.10 each, | 3.30 |
| His real estate must then pay | 55.17 |
| His personal estate, | 7.89 |
| Three polls at \$1.10 each, | 3.30 |
| Total B's tax for town, state, | <hr/> |
| and county, | \$66.36 |

NOTE.—To find what proportion the State or the county tax bears to the whole tax; divide the whole amount of taxes by the State or county tax, and the quotient will show the fractional part.

Thus, as \$277.20 is $\frac{1}{10}$ of \$2772.00, the State tax will be $\frac{1}{10}$ of the whole amount of the taxes; and as \$554.40 is $\frac{1}{5}$ of \$2772.00, the county tax will be $\frac{1}{5}$ of all the taxes.

The amount of taxes which any man will pay, may be calculated without the table, by multiplying his real or personal estate by the sum that is to be assessed on one dollar. Thus B's real estate \$3678, by multiplying it by \$0.015 we shall have \$55.17, for his tax on it. And by multiplying his personal estate \$526 by \$0.015, we have \$7.89 for the tax.

NOTE.—The tax on personal estate is often specific.

Method of assessing Parish Taxes.

First. Say, as the amount of the taxes, which the town pays to the State, is to the amount of what the polls in the town pay to the State, so is the sum to be raised by the parish, to the sum that must be assessed on the polls. Then say, as the number of polls in the parish is to the sum that must be assessed on the polls, so is one poll to what each poll has to pay. Then multiply the number of polls in the parish by the sum that is to be assessed on each poll, subtract the amount from the sum which the parish is to raise, and note the remainder; then say, as the valuation of the parish is to the remainder, so is one dollar to what must be assessed on the dollar.

NOTE.—The same rule is to be observed in assessing society and school-district taxes.

QUESTION.

2. The town of A pays \$277.20 to the State; \$46.20 of which is assessed on the polls. The valuation of south parish is \$95.000, and there are 288 polls. The parish vote to raise \$684 to defray parish charges. What will be B's tax, who is an inhabitant of the south parish, and whose real estate is \$3678, personal estate \$526, and has three polls?

OPERATION.

\$277.20 : \$46.20 :: \$684 : \$114 = Sum to be assessed on polls.

Polls. Poll.
Then 228 : \$114 :: 1 : 50 = Sum to be assessed on each poll.

| | |
|----------|--------|
| 228 | 684 |
| .50 | 114 |
| <hr/> | <hr/> |
| \$114.00 | \$570. |

\$95.000 : \$570 :: \$1 : \$0.00.6 = Assessed on the dollar.

To find the amount of B's tax, we multiply his real estate, \$3678 by \$0.00.6, the sum to be assessed on a dollar, and find the product to be \$22.06.8.

By the same process, we find the tax on his personal estate to be \$3.15.6.

| | |
|------------------------------------|-----------|
| Therefore his real estate is taxed | \$22.06.8 |
| his personal estate, | 3 15.6 |
| his 3 polls at 50 cents each, | 1.50.0 |

\$26.72.4

3. In the same parish what will be the amount of C's tax, whose real estate is \$1728, his personal, \$378, and he has 4 polls?
Ans. \$14.63.6.

BANKING.

A Bank is a place of deposit for money, which is usually divided in several shares, and owned by persons called *stockholders*. Its concerns are managed by a Board of Directors. It issues notes or bills of its own, intended to be a circulating medium of exchange or currency, instead of gold and silver. These bills are obtained from the bank by loans. When

money is hired from a bank, it is the usual custom to deduct the interest at the time of receiving it. A man, therefore, who hires money from a bank, gives his note for a sum as much larger than he receives, as is the interest of the note for the given time. If a man therefore gives his note for \$100, payable in 63 days, he *receives* only \$98.95.

A promissory note is said to be *discounted*, when it is received at a bank as a security for money taken from it; and the interest deducted is the discount. The interest on every note discounted at a bank, is computed for 3 days more than the time specified in the note; that is, if the note is payable in 60 days, the interest is taken for 63 days; for the law allows 3 days to the debtor, after the time has expired for payment, which are called *days of grace*.

The rule for computing the discount is the same as in simple interest.

EXAMPLES.

1. What is the bank discount on \$476, for 30 days and grace?
Ans. \$2.61.8.

2. What is the bank discount on \$1000 for 60 days, and grace?
Ans. \$10.50.

3. What is the bank discount on \$7800, for 90 days and grace?
Ans. \$120.90.

4. What is the bank discount on \$8000 for 60 days and grace?
Ans. \$84.00.

5. How much money should be received on a note for \$760, payable in 5 months, discounted at a bank when the interest is 6 per cent.?
Ans. \$740.62.

6. What sum is paid at a bank for a note of \$1728, payable in 3 months?
Ans. \$1701.21.6.

7. A merchant sold a cargo of hemp for \$7860, for which he received a note, payable in 6 months. How much money will he receive at a bank for this note?
Ans. \$7620.27.

8. A merchant bought 450 quintals of fish at \$3.50 cash, and sold them immediately for \$4.00 on 6 months' credit, for which he received a note. If he should get this discounted at a bank, what will he gain on the fish?
Ans. \$170.10.

BARTER.

Barter is the exchange of one kind of merchandize for another, without loss to either party.

Questions in this rule are solved, by finding what quantity of goods, at a given price of one kind, are equal in value to another kind of goods, whose price is also given.

EXAMPLES.

1. How much sugar at $12\frac{1}{2}$ cents per lb. must be given in barter, for 760 lbs. of raisins at 8 cents per lb. ?

Ans. 486 lbs.

2. What quantity of coffee at 17 cents per lb. must be given in barter for 760 lbs. of tea, at $62\frac{1}{2}$ cents per lb. ?

Ans. 2794 $\frac{1}{2}$ lbs.

3. A merchant delivered 3 hogsheads of wine at \$1.10 for 126 yards of cloth ; what was the cloth per yard ?

Ans. \$1.65.

4. A has 12 cwt. of sugar, worth 8 cents per lb. for which B gave him $1\frac{1}{4}$ cwt. of cinnamon ; what did B value his cinnamon ?

Ans. \$0.54 $\frac{1}{2}$ per lb.

5. A had 41 cwt. of hops at \$6.70 per cwt. for which B gave him 17 cwt. 3 qrs. 4 lbs. of prunes, and \$88 ; what were the prunes valued at per lb. ?

Ans. \$0.09 $\frac{3}{4}$ $\frac{1}{2}$.

6. A has sugar, which he barter with B for 4 cents per lb. more than it cost him, against tea, which cost B 40 cents per lb., but which he puts in barter at 50 cents. What did A's sugar cost him per lb. ?

Ans. \$0.16.

7. How many staves at \$25 per thousand, must a merchant receive for 15 hogsheads of wine, at \$1.25 per gallon ?

Ans. 4725 staves.

8. Q has 670 bushels of oats, which cost him 35 cents per bushel ; then he barter with Z, at 50 cents per bushel for flour, that cost Z \$5.00 per barrel. What is the bartering price of the flour, and how much will Q receive ?

Ans. 46 $\frac{2}{3}$ barrels of flour at \$7.14 $\frac{2}{3}$ per barrel.

LOSS AND GAIN.

Loss and Gain is a rule by which merchants estimate their *profit and loss*, in buying and selling goods

The questions are performed by *proportion*, and the other preceding rules.

1. Sold broadcloth at \$6.12 $\frac{1}{2}$ per yard, and by so doing I lost 12 $\frac{1}{2}$ per cent. What was the original cost per yard?

Ans. \$7.00.

2. Bought cloth at \$7.00 per yard, and sold it at \$6.12 $\frac{1}{2}$. What did I lose per cent.?

Ans. 12 $\frac{1}{2}$ per cent.

3. Bought cloth at \$7.00 per yard, and sold it for 12 $\frac{1}{2}$ per cent. less than what it cost. What did I receive?

Ans. \$6.12 $\frac{1}{2}$.

4. Bought cloth at \$3.60 per yard. For how much must I sell it to gain 12 $\frac{1}{2}$ per cent.?

Ans. \$4.05.

5. Sold cloth at \$4.05 per yard, and by so doing I gained 12 $\frac{1}{2}$ per cent. What did it cost?

Ans. \$3.60.

6. Bargained for cheese at \$8.50 per cwt. For how much must I sell it to gain 10 per cent.?

Ans. \$9.35 per cwt.

7. Sold cheese at \$9.35 per cwt. and gained 10 per cent. What did I give for it?

Ans. \$8.50 per cwt.

8. Sold wine at \$1.25 per gallon, and by so doing lost 15 per cent. For what should I have sold it to gain 12 per cent.?

Ans. \$1.64.7 $\frac{1}{7}$ per gallon.

9. Sold wine at \$1.25 per gallon, and lost 15 per cent. What per cent. should I have gained, had I sold it for \$1.64.7 $\frac{1}{7}$ per gallon?

Ans. 12 per cent.

10. Sold wine for \$1.64.7 $\frac{1}{7}$ per gallon, and gained 12 per cent. For what should I have sold it to lose 15 per cent.?

Ans. \$1.25 per gallon.

11. Sold wine for \$1.64.7 $\frac{1}{7}$ per gallon, and gained 12 per cent. What should I have lost, had I sold it for \$1.25 per gallon?

Ans. 15 per cent.

12. A buys corn for \$0.90 per bushel, and sells it for \$1.20. B buys for \$1.12 $\frac{1}{2}$, and sells for \$1.50; who gains the most per cent. ?

Ans. both gain alike.

13. If I buy cotton cloth at 13 cents per yard, on 8 months' credit, and sell it again at 12 cents cash, do I gain or lose, and how much per cent. ?

Ans. lose 4 per cent.

14. If 24 yards of cloth are sold at \$2.50 per yard, and there is 7 $\frac{1}{2}$ per cent. loss in the sale, what is the prime cost of the whole ?

Ans. \$64.86.4 $\frac{3}{4}$.

15. Bought 24 yards of cloth for \$64.86.4 $\frac{3}{4}$. For what must I sell it per yard to lose 7 $\frac{1}{2}$ per cent. ?

Ans. \$2.50.

16. Bought a certain quantity of cloth for \$64.86.4 $\frac{3}{4}$, and by selling it at \$2.50 per yard, I lost 7 $\frac{1}{2}$ per cent. How many yards were bought ?

Ans. 24 yards.

17. Bought 24 yards of cloth for \$64.86.4 $\frac{3}{4}$, and sold it at \$2.50 per yard; what is lost per cent. ?

Ans. 7 $\frac{1}{2}$ per cent. ?

18. If 27 $\frac{1}{2}$ cwt. of sugar be sold at \$12.50 per cwt. and there is gained 17 per cent. what was the first cost ?

Ans. \$10.68.3 $\frac{11}{17}$.

19. Sold a horse for \$75, and by so doing, I lost 25 per cent.; whereas, I ought to have gained 30 per cent. How much was it sold under its real value ?

Ans. \$55.00.

20. Bought a horse, which was worth 30 per cent. more than I gave for him; but having been injured, I sold him for 25 per cent. less than what he cost, and thereby lost \$55 on his real value. What was received for the horse ?

Ans. \$75.00.

21. Bought molasses at 42 cents per gallon, but not proving so good as I expected, I am willing to lose 5 per cent. For what must I sell it per gallon ?

Ans. \$0.39.9.

22. Bought a hogshead of wine for \$112, but 15 gallons having leaked out, I am willing to lose 5 per cent. on the cost. For how much per gallon must I sell it ?

Ans. \$2.21.6 $\frac{3}{4}$.

23. Bought a hogshead of wine for \$112, but a number of gallons having leaked out, I sell the remainder for \$2.21.6 $\frac{3}{4}$ per gallon, and by so doing I lose 5 per cent. on the cost. How many gallons leaked out ?

Ans. 15 gallons.

24. Bought a hogshead of wine for a certain sum, but 15 gallons having leaked out, I sell the remainder for \$2.21.6 $\frac{3}{4}$ per gallon, and thereby lose 5 per cent. on the cost. What was the cost ?

Ans. \$112.00.

25. Bought a hogshead of wine for \$112.00, but 15 gallons having leaked out, I sell the remainder at \$2.21.6 $\frac{2}{3}$ per gallon. What is my loss per cent. ?

Ans. 5 per cent.

26. If I sell cloth at \$5.60 per yard, and thereby lose 7 per cent., should I gain or lose, and how much per cent. by selling it at \$6.25 per yard ?

Ans. 3 $\frac{27}{44}$ per cent. gain.

27. Sold a watch which cost me \$30 for \$35, on a credit of 8 months. What did I gain by the bargain ?

Ans. \$3.65.3 $\frac{1}{4}$.

28. When tea is sold at \$1.25 per lb. there is lost 25 per cent. ; what would be the gain or loss per cent. if it should be sold at \$1.40 per lb. ?

Ans. 16 per cent. loss.

29. A exchanges with B 50 lbs. of indigo at \$1.00 per lb. cash, and in barter \$1.35; but he is willing to lose 12 per cent. to have $\frac{1}{2}$ ready money. What is the cash price of 1 yard of cloth delivered by B at \$5.00 per yard to equal A's bartering price, and how many yards were delivered ?

Ans. \$4.20.3 $\frac{8}{9}$ cash price of 1 yard,
7 $\frac{2}{3}$ yards delivered by B.

EQUATION OF PAYMENTS.

When several sums of money, to be paid at different times, and reduced to a *mean* time, for the payment of the whole, without gain or loss to the debtor or creditor; it is called Equation of Payments.

RULE.*

Multiply each payment by the time, at which it is due; then divide the sum of the products by the sum of the payments, and the quotient will be the true time required.

* This is the rule usually adopted by merchants, but it is not *perfectly* correct; for if I owe a man \$200, and \$100 of which I was to pay *down*, and the other \$100 in 2 years, the equated time for the payment of both sums would be one year. It is evident that for deferring the payment of

EXAMPLES.

1. A owes B \$19; \$5 of which is to be paid in 6 months, \$6 in 7 months, and \$8 in 10 months. What is the *equated* time for the payment of the whole?

$$\begin{array}{r} \$5 \times 6 = 30 \\ \$6 \times 7 = 42 \\ \$8 \times 10 = 80 \\ \hline 152 \end{array}$$

$$19 \quad 19)152(8 \text{ months.}$$

$$152$$

By analysis. \$5 for 6 months is the same as \$1 for 30 months; and \$6 for 7 months, is the same as \$1 for 42 months; and \$8 for 10 months, is the same as \$1 for 80 months; therefore \$1, for $30+42+80=152$ months, is the same as \$5 for 6 months, \$6 for 7 months, and \$8 for 10 months; but \$5, \$6, and \$8 are \$19; therefore \$1 for 152 months, is the same as \$19 for $\frac{1}{19}$ of 152 months, which is 8 months, as before.

2. A owes B \$300, of which \$50 is to be paid in 2 months, \$100 in 5 months, and the remainder in 8 months. What is the equated time for the whole sum? Ans. 6 months.

3. There is owing to a merchant \$1000; \$200 of it is to be paid in 3 months, \$300 in 5 months, and the remainder in 10 months. What is the equated time for the payment of the whole sum? Ans. 7 months, 3 days.

4. A owes B \$150, \$50 to be paid in 4 months, and \$100 in 8 months. B owes A \$250 to be paid in 10 months. It is agreed between them, that A shall make present payment of his whole debt, and that B shall pay his so much sooner as to balance the favor. I demand the time at which B must pay the \$250? Ans. 6 months.

5. A merchant has \$144 due him, to be paid in 7 months, but the debtor agrees to pay $\frac{1}{3}$ ready money, and $\frac{1}{3}$ in 4 months. What time should be allowed him to pay the remainder?

Ans. 2 years, 10 months.

the first \$100 for 1 year, I ought to pay the amount of \$100 for that time, which is \$106; but for the other \$100, which I pay a year *before* it is due, I ought to pay the *present worth* of \$100, which is \$94.33 $\frac{1}{3}$; I therefore *should* pay \$200.33 $\frac{1}{3}$, whereas, by Equation of Payments, I only pay \$200. *Strict justice* would therefore demand, that *interest* should be required on all sums from the time they become due, until the time of payment; and the *present worth* of all sums, paid *before* they are due. The better rule would be to find the present worth on each of the sums due, and then find in what time the sum of these present worths would amount to the payments.

6. There is due to a merchant \$800, $\frac{1}{3}$ of which is to be paid in 2 months, $\frac{1}{3}$ in 3 months, and the remainder in six months; but the debtor agrees to pay $\frac{1}{3}$ down. How long may the debtor retain the other half so that neither party may sustain loss?

Ans. $8\frac{1}{3}$ months.

7. I have purchased goods of A. B. at sundry times and on various terms of credit, as by the statement annexed. When is the *medium* time of payment?

| | | | | |
|-------|-----|---------------------|----------|----------------------|
| Jan. | 1, | a bill amounting to | \$375.50 | on 4 months' credit. |
| " | 20, | do. do. | 168.75 | on 5 months' credit. |
| Feb. | 4, | do. do. | 386.25 | on 4 months' credit. |
| March | 11, | do. do. | 144.60 | on 5 months' credit. |
| April | 7, | do. do. | 386.90 | on 3 months' credit. |

Form of statement.

| | | |
|------------|-----------------------|---------------------------|
| Due May 1, | \$375.50 | |
| June 20, | $168.75 \times 50 =$ | 843750 |
| June 4, | $386.25 \times 34 =$ | 1313250 |
| Aug. 11, | $144.60 \times 102 =$ | 1474920 |
| June 7, | $386.90 \times 67 =$ | 2592230 |
| | 1462.00 | 6224150 |
| | | 421874 Answer. |
| | | 584800 |
| | | <hr/> |
| | | 376150 |
| | | 292400 |
| | | <hr/> |
| | | 83750 |

The medium time of payment will therefore be $42\frac{1874}{584800}$ days, that is 43 days from May 1, which will be June 12.

I have sold to C. D. several parcels of goods, at sundry times, and on various terms of credit, as by the statement annexed.

| | | |
|------------|---------------------|----------------------------|
| January 1, | a bill amounting to | \$600 on 4 months' credit. |
| Feb. 7, | do. do. | 370 on 5 months' credit. |
| March 15, | do. do. | 560 on 4 months' credit. |
| April 20, | do. do. | 420 on 6 months' credit. |

When is the equated time for the payment of all the bills?

Ans. July 10.

CUSTOM HOUSE BUSINESS.

In every port of the United States, where merchandise is either exported or imported, there is an establishment called a Custom House. Connected with this are certain officers appointed by government, called custom house officers, whose business is to collect the duties on various kinds of merchandise, &c. imported into the United States.

The following article on allowances, &c. was very politely furnished the author by the officers of the Boston Custom House, and may therefore be relied on as perfectly correct.

Allowances.

Draft is an allowance made by the officers of the United States Government in the collection of duties on merchandise, liable to a specific duty, and ascertained by weight, and is also given by the usage of merchants in buying and selling. It is a deduction from the actual gross weight of the article paying duty by the pound or sold by weight.

For example, a box of sugar *actually* weighs 500 pounds. The draft upon this weight is 4 pounds.

500 gross.

4 draft.

496 difference. Upon this difference is made a further allowance of fifteen per cent. as *tare*, or as the actual weight of the box before the sugar was put into it. This tare is allowed by the government in the collection of the duty, and by the merchant in buying and selling. Take then the box of sugar, say 500lbs. gross.

4 draft.

496 difference.

74 tare

422 nett weight, upon which a duty is paid to the govern-

ment, or price is paid to the merchant in his sale. This tare of 74 pounds or 15 per cent., is usually more than the *actual tare*, but is assumed as the *probable or actual tare*, by reason of the impossibility of starting every box to ascertain the *actual* weight of the sugar, and the *actual* weight of the box which contains it. This *tare* is sufficiently correct for the collector of the duty, and the merchant who deals in the article. It is intended to be a liberal allowance, and varies but little from the *actual tare*.

Drafts allowed at the Custom House in the collection of duties, and by the merchants in their purchases and sales are as follow—

Allowance for draft.

Draft is another name for *Trett*, which is an allowance in weight for waste.

| lbs. | | lbs. |
|---------------------------------|-----|--------|
| On 112 | | 1 |
| Above 112 and not exceeding 224 | | 2 |
| " 224 | " " | 336 3 |
| " 336 | " " | 1120 4 |
| " 1120 | " " | 2016 7 |
| " 2016 | " " | 9 |

EXPLANATION.—Many articles of merchandise are weighed separately; for example,—boxes and casks of sugar, chests of tea and indigo. Upon each box or cask, or chest, an allowance should be made for draft, according to its weight, as by the above rule. Bags of sugar and coffee, or bars of iron and bundles of steel might be weighed together; say, 10 bags of coffee at one draft might weigh 1121 pounds; from this gross weight must be deducted 7 pounds as draft; 35 bars of Russia iron might be weighed at one draft—weight 2250 pounds, upon which would be an allowance of 9 pounds draft, and by law and usage there can be no greater allowance than 9 pounds for draft. A greater or less number of bags of coffee or bars of iron, or any other article of merchandise is weighed, and the deduction is according to the weight of each draft. An old rule, and probably a better one among merchants, was the allowance of $\frac{1}{4}$ per cent. on the gross-weight of all merchandise weighed, as *draft*.

Allowance for leakage.

Two per cent. is allowed on the gauge of ale, beer, porter,
18*

brandy, gin, molasses, oil, wine and rum and other liquors in casks; besides the *real* wants of the cask; for example,—a cask of molasses may gauge 140 gallons, gross gauge,—from this first deduct 5 gallons, the *actual* wants, or the quantity necessary to fill the cask—we have,

140 gross.

5 out.

135 difference.

3—2 per cent. for leakage.

132 gallons nett.

Tare is an allowance made for the *actual or supposed weight* of the cask, box, case or bag which contains the article of merchandise.

The usage of merchants is in conformity with the law and usage of the officers of the customs in their allowance for tare, directed by law, or found to be correct by their examination and experience.

The following table gives the legal tare; and when the law determines no tare, the *actual* tare is stated as usually allowed, and by experience found to be correct.

Tares according to law and actual weight.

A

Almonds, in bags, 3 per cent.

Alum, casks 12 per cent.

B

Bristles, Cronstadt 12 per cent. *actual*.

do. Archangel 14 do. do.

Beef, jerk'd hhds. 112lbs per hhd.

do. do. drums 70 "

C

Cordage, matts $1\frac{3}{4}$ per cent. *actual*.

Camphor, crude, in tubs 35 do. do. in tubs.
do. refined

Candles, boxes 8 do. *legal*.

do. chests, 160lbs. 20 do. *actual*.

Cinnamon, do. 16 " per chest.

| | | | |
|--|---------------|----------------------|----------------|
| Cinnamon, matts | 8 per cent. | <i>legal.</i> | |
| Cloves, casks | 15 do. | <i>actual.</i> | |
| Cocoa, in bags | 1 do. | <i>legal, actual</i> | 2 per ct. |
| do. casks | 10 do. | do. | |
| do. zeroons | 10 do. | do. | |
| Chocolate, boxes | 10 do. | do. | |
| Coffee, bags, W. India | 2 do. | do. | |
| do. East India, grass bags 2lbs. per bag | | | <i>actual.</i> |
| do. bales | 3 per cent. | <i>legal.</i> | |
| do. casks | 12 do. | do. | |
| Cotton, bales | 2 do. | do. | |
| do. zeroons | 6 do. | do. | |
| Currants, casks | 12 do. | <i>actual.</i> | |
| Cheese, hampers or baskets | 10 do. | do. | |
| do. boxes | 20 do. | do. | |
| Copperas, casks | 12 do. | do. | |
| Candy sugar, in baskets | 5 do. | do. | |
| do. do. boxes | 10 do. | <i>legal.</i> | |
| Corks, bales | 15 and 20lbs. | <i>actual.</i> | |

F

| | | | |
|-----------------|--------------|-------|----------------|
| Figs, boxes | 60lbs. | 9lbs. | <i>actual.</i> |
| do. half boxes | 30 " | 5½ " | do. |
| do. quarter do. | 15 " | 3¼ " | do. |
| do. drums | 10 per cent. | | <i>legal.</i> |
| Frails | 5 do. | | <i>actual.</i> |

G

Glue, bales, Russia 5lbs. *actual.*

I

| | | | |
|-----------------------|-------------|---------------|--|
| Indigo, bags or matts | 3 per cent. | <i>legal.</i> | |
| do. zeroons | 10 do. | do. | |
| do. barrels | 12 do. | do. | |
| do. other casks | 15 do. | do. | |
| do. cases | 20 do. | do. | |

L

| | | | |
|-------------------------|--------------|----------------|--|
| Lines, bales | 2 do. | <i>actual.</i> | |
| Looking-glasses, French | 30 per cent. | <i>actual.</i> | |

M

Mace, casks or kegs 33 per cent. *actual*.

N

Nutmegs 12 per cent. *actual*.

Nails, casks 8 per cent. *legal*.

O

Ochre, French, casks 12 per cent. *actual*.

P

Pepper, bags 2 per cent. *legal*.

do. bales 5 do. do.

do. casks 12 do. do.

Pimento, bags 3 do. do.

do. bales 5 do. *actual*.

do. casks 15 do. *legal*.

Prunes, boxes, 7lbs. per box.

R

Raisins, Malaga, boxes 6lbs. *actual*.

do. do. jars 5 " do.

do. do. casks 12 " do.

do. Smyrna do. 12 per cent. *actual*.

S

Sugar, Java, in willow baskets 60lbs. per basket *actual*.

Sugar, bags or matts 5 per cent. *legal*.

do. casks 12 do. do.

do. boxes 15 do. do.

do. canisters 35 do. *actual*.

Sugar candy, baskets 5 do. do.

do. do. boxes 10 do. *legal*.

Soap, boxes 10 do. do.

MEMORANDUM.—Actual tare of soap more than legal tare.
Invoice tare usually claimed at Custom House.

| | | | |
|---------------------------------|----|-----------|--------------------|
| Soap, Marseilles, in boxes | 12 | per cent. | <i>actual.</i> |
| Salts, glauber, in casks | 8 | do. | <i>legal tare.</i> |
| Shot, casks | 3 | do. | do. |
| Steel, bundles 2lbs. per bundle | | | <i>actual.</i> |
| do. cases 60lbs. per case | | | <i>actual.</i> |

T

| | | | |
|-----------------|----|------------|----------------|
| Tea chests | 22 | lbs. each. | |
| " half chests | 14 | " do. | |
| " caddy boxes | 6 | " do. | |
| Twine, casks | 12 | per cent. | <i>legal.</i> |
| do. bales | 3 | do. | do. |
| Tallow, zeroons | 10 | do. | <i>actual.</i> |
| do. casks | 12 | do. | do. |

W

| | | | |
|-----------------------|----|---------------|----------------|
| Wool, bales, Smyrna | 10 | lbs. per bale | <i>actual.</i> |
| do. do. Hamburgh | 3 | per cent. | do. |
| do. do. South America | 15 | lbs. per bale | do. |

EXAMPLES.

1. Find the nett weight of 20 hogsheads of sugar, each weighing gross, 7 cwt. 2 quarters; draft and tare as found in the tables.

16800lbs. gross weight.
80lbs. draft.

16720

12 per cent. of 16720 = 2006lbs. tare.

14724lbs. neat weight.

2. Find the nett weight of 80 boxes of sugar, weighing each 4 cwt. 3 quarters 18 pounds. Ans. 371280lbs.

3. What is the nett weight of 14 chests of souchong tea, weighing each 112 pounds? Ans. 1246lbs.

4. Required the nett weight of 30 boxes of Malaga raisins, weighing each 126 pounds? Ans. 3540lbs.

5. Required the nett weight of 50 boxes chocolate, each weighing 150 pounds? Ans. 6660lbs.

6. Find the nett weight of 10 bags of pepper, weighing each 150 pounds.
Ans. 1450lbs.

7. What is the nett weight of 12 casks of cloves, weighing each 224 pounds?
Ans. 2254lbs.

8. What is the nett weight of 17 kegs of mace, weighing each 112 pounds?
Ans. 1264lbs.

NOTE.—In making allowances, if there be a fraction of more than half a pound, 1 pound is added to the tare.

American Duties.

The duties on merchandise imported into the United States are either specific or ad valorem duties.

Specific duty is a certain sum paid on a ton, hundred weight, pound, square yard, gallon, &c.; but when the duty is a certain per cent. on the actual cost of the goods in the country, from which they are imported, it is called an *ad valorem duty*.

EXAMPLES.

1. What is the duty on 10 hogsheads of sugar, weighing gross 12760 pounds, draft and tare as stated in the tables, duty 2½ cents per pound?
Ans. \$279.17.5.

2. What is the duty on an invoice of woolen goods, which cost in London 986£ sterling, at 44 per cent. ad valorem?
Ans. \$1928.17+.

3. What is the duty on 10 pipes of Port wine, duty 15 cents per gallon, allowance as in the table?
Ans. \$185.25.

4. What is the duty on 15 boxes of Naples soap, weighing gross 120 pounds each, invoiced at \$1.10 per pound, duty 15 per cent. ad valorem?
Ans. 265.15.5.

5. What is the duty on a cargo of iron, weighing 270 tons, at \$30 per ton?
Ans. \$8.100.

6. Compute the duty on 7890 pounds of tarred cordage, at 4 cents per pound.
Ans. \$310.06.

7. What should be paid on 10 casks of nails, weighing gross 450 pounds each, at 4 cents per pound?
Ans. \$164.04.

DUODECIMALS AND CROSS MULTIPLICATION.

Duodecimals are so called, because they decrease by twelves from the place of feet towards the right.

Inches are called *primes* and are marked thus $'$; the next division after is called *seconds*, marked thus $''$; the next is *thirds*, marked thus $'''$; and so on.

Duodecimals are commonly used by workmen and artificers in finding the contents of their work.

RULE.

Under the multiplicand write the same names or denominations of the multiplier; that is, feet under feet, inches under inches, &c. Multiply each term in the multiplicand, beginning at the lowest by the feet of the multiplier, and write each result under its respective term, observing to carry a unit for every 12 from each denomination to its next superior. In the same manner the multiplicand by the inches of the multiplier, and set the result of each term one place further towards the right of those in the multiplicand. Proceed in the same manner with the seconds and all the rest of the denominations, and the sum of all the lines will be the product required.

The denomination of the particular products will be as follows.

Feet multiplied by feet, give feet.

Feet multiplied by primes, give primes.

Feet multiplied by seconds, give seconds.

Primes multiplied by primes, give seconds.

Primes multiplied by seconds, give thirds.

Primes multiplied by thirds, give fourths.

Seconds multiplied by seconds, give fourths.

Seconds multiplied by thirds, give fifths.

Seconds multiplied by fourths, give sixths.

Thirds multiplied by thirds give sixths.

Thirds multiplied by fourths, give sevenths.

Thirds multiplied by fifths, give eighths, &c.

EXAMPLES.

1. Multiply 6 feet 8 inches by 4 feet 5 inches.

6ft. 8'

4 5'

26 8'

2 11' 4"

29ft. 7' 4"

Ans. 29ft. 7' 4".

As feet are the integer or units, it is evident, that the feet multiplied by feet will produce feet; and as inches are twelfth of a foot, the product of inches by feet will be twelfths of a foot or inches. For the same reason inches multiplied by inches will produce twelfths of an inch, or one hundred

forty-fourths of a foot.

2. Multiply 4 feet 7' by 6 feet 4'.

Ans. 29ft. 0' 4".

3. Multiply 14 feet 9' by 4 feet 6'.

Ans. 66ft. 4' 6".

4. Multiply 4 feet 7' 8" by 9 feet 6'

Ans. 44ft. 0' 10".

5. Multiply 10 feet 4' 5" by 7 feet 8' 6".

Ans. 79ft. 11' 0" 6" 6".

6. Multiply 39 feet 10' 7" by 18 feet 8' 4".

Ans. 745ft. 6' 10" 2" 4".

7. How many square feet in a floor 48 feet 6' long 24 feet 3' broad?

Ans. 1176ft. 1' 6".

8. What are the contents of a marble slab, whose length is 5 feet 7', and breadth 1 foot 10'?

Ans. 10ft 2' 10".

9. The length of a room being 20 feet, its breadth 14 feet 6 inches, and height 10 feet 4 inches; how many yards of painting are in it, deducting a surplus of 4 feet by 4 feet 4 inches, and two windows, each 6 feet by 3 feet 2 inches?

Ans. 73 $\frac{2}{3}$ yds.

10. Required the solid contents of a wall 53 feet 6 inches long, 10 feet 3 inches high, and 2 feet thick?

Ans. 1310ft. 9".

11. There is a house with 4 tiers of windows, and 4 windows in a tier; the height of the first is 6 feet 8 inches; of the second 5 feet 9 inches; of the third 4 feet 6 inches; of the fourth 3 feet 10 inches; and the breadth is 3 feet 5 inches; how many square feet do they contain in the whole?

Ans. 283ft. 7in.

12. How many feet of boards would it require to make 15 boxes, each of which is 7 feet 9 inches long, 3 feet 4 inches wide, and 2 feet 10 inches high; and how many cubic yards would they contain?

Ans. 1702ft. 11in. 40 $\frac{7}{10}$ cubic yds.

13. A mason has plaistered 3 rooms, the ceiling of each is 20 feet by 16 feet 6 inches, and the walls of each 9 feet 6 inches high; there is to be 90 yards deducted for doors, windows, &c. How many yards must he be paid for?

Ans. 251 yds. 1 ft. 6 in.

14. How many feet in a board which is 17 feet 6 inches long, and 1 foot 7 inches wide?

Ans. 27 ft. 8' 6".

15. How many feet in a board 27 feet 9 inches long, 29 inches wide?

Ans. 67 ft. 0' 9".

16. How many feet of boards will it take to cover the side of a building 47 feet long, 17 feet 9 inches high?

Ans. 834 ft. 3'.

NOTE.—A board to be merchantable should be 1 inch thick; therefore to reduce it to plank measure, the superficial contents of the plank should be multiplied by its thickness.

17. How many feet, board measure, are in a plank 18 feet 9 inches long, 1 foot 6 inches wide, and 3 inches thick?

Ans. 84 ft. 4' 6".

18. How many feet, board measure, are in a plank 20 feet long, 1 foot 6 inches wide, and $2\frac{1}{2}$ inches thick?

Ans. 75 ft.

19. How many feet in a plank 40 feet 6 inches long, 30 inches wide, and $2\frac{3}{4}$ inches thick?

Ans. 278 ft. 5' 3".

NOTE.—A pile of wood that is 8 feet long, 4 feet high, and 4 feet wide, contains 128 cubic feet, or a cord; and every cord contains 8 *cord-feet*; and as 8 is $\frac{1}{16}$ of 128, every *cord-foot* contains 16 cubic feet; therefore, dividing the cubic feet in a pile of wood by 16, the quotient is the cord-feet; and if cord-feet be divided by 8, the quotient is cords.

20. How many cords of wood in a pile 18 feet long, 6 feet high, and 4 feet wide?

Ans. $3\frac{3}{4}$ cords.

21. How many cords in a pile 10 feet long, 5 feet high, 7 feet wide?

Ans. 2 cords, 94 cubic feet.

22. How many cords in a pile 35 feet long, 4 feet wide, 4 feet high?

Ans. $4\frac{3}{4}$ cords.

23. How many cords in a pile that measures 8 feet on each side?

Ans. 4 cords.

24. How many cords in a pile that is 10 feet on each side?

Ans. $7\frac{3}{4}$ cords.

NOTE.—When wood is 'corded' in a pile 4 feet wide, by multiplying its length by its height, and dividing the product by 4, the quotient is the cord-feet; and if a load of wood be 8 feet long, and its height be multiplied by its width, and the product divided by 2, the quotient is the cord-feet.

25. How many cords of wood in a pile 4 feet wide, 70 feet 6 inches long, and 5 feet 3 inches high? Ans. $11\frac{2}{3}$ cords.

NOTE.—Small fractions are rejected.

26. How many cords in a pile of wood, 97 feet 9 inches long, 4 feet wide, and 3 feet 6 inches high?

Ans. $10\frac{2}{3}$ cords.

27. Required the number of cords of wood in a pile 100 feet long, 4 feet wide, and 6 feet 11 inches high? Ans. $21\frac{2}{3}$.

28. Agreed with a man for 10 cords of wood, at \$5.00 a cord; it was to be cut 4 feet long, but by *mistake* it was cut only 46 inches long. How much in *justice* should be deducted from the *stipulated* price? Ans. \$2.08 $\frac{2}{3}$.

29. If a load of wood be 8 feet long, 3 feet 8 inches wide, and 5 feet high; how much does it contain? Ans. $9\frac{1}{2}$ cord-feet.

30. If a load of wood be 8 feet long, 3 feet 10 inches wide, and 6 feet 6 inches high; how much does it contain?

Ans. $12\frac{1}{2}$ cord-feet.

31. If a load of wood be 8 feet long, 3 feet 6 inches wide; how high should it be to contain 1 cord? Ans. 4 ft. 6' $10\frac{2}{3}$.

32. If a load of wood be 12 feet long and 3 feet 9 inches wide; how high should it be to contain 2 cords.

Ans. 5 ft. 8' $3\frac{1}{2}$.

CROSS MULTIPLICATION.

Cross Multiplication differs from duodecimals, in not having the inferior denominations confined to *twelves*; for any number, whether its inferior denominations decrease from the integer in the same ratio or not, may be multiplied crosswise; and for the better understanding it, the learner must observe the following

RULE.

That if he multiplies any denomination by an integer, the value of an unit in the product will be equal to an unit in the multiplicand; but, if he multiplies by any number of an inferior denomination, the value of an unit in the product will be so much inferior to the value of an unit in the multiplicand, as an unit of the multiplier is less than an integer.

Thus, pounds multiplied by pounds are pounds; pounds multiplied by shillings are shillings, &c.; shillings multiplied by pence are twentieths of a penny; pence multiplied by pence are two hundred and fortieths of a penny, &c.

EXAMPLES.

33. Multiply 3£ 6s. 8d. by 2£ 5s. 7d.

| | £ | s. | d. |
|------------------|-----|----|------|
| | 3 | 6 | 8 |
| | 2 | 5 | 7 |
| <hr/> | | | |
| 3£ × 2£ = 6£ | = 6 | 0 | 0 |
| 6s. × 2£ = 12s. | = 0 | 12 | 0 |
| 8d. × 2£ = 16d. | = 0 | 1 | 4 |
| 3£ × 5s. = 15s. | = 0 | 15 | 0 |
| 6s. × 5s. = 30s. | = 0 | 1 | 6 |
| 8d. × 5s. = 40d. | = 0 | 0 | 2 |
| 3£ × 7d. = 21d. | = 0 | 1 | 9 |
| 6s. × 7d. = 42d. | = 0 | 0 | 2 10 |
| 8d. × 7d. = 56d. | = 0 | 0 | 0 70 |

Ans. 7£ 11s. 11½d.

34. Multiply 1£ 19s. 11½d. by 1£ 19s. 11½d.

Ans. 3£ 19s. 9½d.

35. Multiply 3 miles, 4 furlongs and 12 rods, by 2 miles, 6 furlongs, 8 rods, miles being the integer or unit.

Ans. 11m. 6fur. 21rd. 4ft. 11in. 1½br.

36. What is the difference in time between London and Boston, the latter place being 71° 4' west of the former, the sun passing 1° in 4' of a solar day?

Ans. 4h. 44' 16".

37. If a mill be multiplied by a mill, what will be the product, a dollar being the unit?

Ans. 1.000.000 of a dollar.

38. A, B and C bought a drove of sheep in company; A paid 14£ 5s., B 13£ 10s., and C 11£ 5s. They agreed to dispose of them at the market; that each man should take 18s. as pay for his time, &c.; and that the remainder should be divided in proportion to their several stocks. At the close of the sale, they found themselves possessed of 46£ 5s. What was each man's gain, exclusive of the pay for his time, &c.?

1£ 13s. 3d. A's gain.

Ans. 1£ 11s. 6d. B's gain.

1£ 6s. 3d. C's gain.

INVOLUTION.

Involution is the raising of powers from any given number, as a root.

A power is a quantity produced by multiplying any given number, called a *root*, a certain number of times continually by itself, thus,—

$$\begin{array}{ll}
 2 = 2 \text{ is the root, or 1st power of } & 2 = 2^1. \\
 2 \times 2 = 4 \text{ is the 2d power, or square of } & 2 = 2^2. \\
 2 \times 2 \times 2 = 8 \text{ is the 3d power, or cube of } & 2 = 2^3. \\
 2 \times 2 \times 2 \times 2 = 16 \text{ is the 4th power, or biquadrate of } & 2 = 2^4.
 \end{array}$$

The number denoting the power, is called the *index*, or *exponent* of the power. Thus, the fourth power of 3 is 81, or 3^4 ; the second power of 7 is 49, or 7^2 .

To raise a number to any power required.

RULE.

Multiply the given number continually by itself, till the number of multiplications be one less than the index of the power to be found, and the last product will be the power required.

EXAMPLES.

1. What is the 5th power of 4?

$$4 \times 4 \times 4 \times 4 \times 4 = 1024 \text{ Answer.}$$

2. What is the 3d power of 8?

$$\text{Ans. } 512.$$

3. What is the 10th power of 7?

$$\text{Ans. } 282475249.$$

4. What is the 6th power of 5?

$$\text{Ans. } 15625.$$

5. What is the 3d power of $\frac{3}{4}$?

$$\text{Ans. } \frac{27}{64}.$$

6. What is the 5th power of $\frac{1}{3}$?

$$\text{Ans. } \frac{1}{243}.$$

7. What is the 4th power of $2\frac{3}{4}$? Ans. $50\frac{4}{9}$.
 8. What is the 6th power of $1\frac{1}{2}$? Ans. $16\frac{1}{2}$.
 9. What is the 4th power of .045? Ans. .00004100625.

EVOLUTION, OR THE EXTRACTION OF ROOTS.

Evolution, or the reverse of Involution, is the extraction or finding the roots of any given powers.

The *root* is a number whose continual multiplication into itself, produces the power; and is denominated the square, cube, biquadrate, or 2d, 3d, 4th, &c. power, equal to that power. Thus, 4 is the square root of 16, because $4 \times 4 = 16$; and 3 is the cube root of 27, because $3 \times 3 \times 3 = 27$; and so on.

Although there is no number of which we cannot find any power exactly, yet there are many numbers of which precise roots can never be determined; but by the help of decimals, we can approximate towards the root to any assigned degree of exactness.

The roots, which approximate, are called *surd roots*, and those which are perfectly accurate, are called *rational roots*.

Roots are sometimes denoted by writing the character $\sqrt{}$ before the power, with the index of the root over it; thus, the 3d root of 36 is expressed, $\sqrt[3]{36}$, and the second root of 36 is $\sqrt{36}$, the index 2 being omitted when the square root is designed.

If the power be expressed by several numbers with the sign + or — between them, a line is drawn from the top of the sign over all the parts of it; thus, the 3d root of $\overline{42+22}$ is $\sqrt[3]{\overline{42+22}}$, and the 2d root of $\overline{59-17}$, is $\sqrt{\overline{59-17}}$, &c.

Sometimes roots are designed like powers with fractional indices. Thus, the square root of 15 is $15^{\frac{1}{2}}$, the cube root of 21 is $21^{\frac{1}{3}}$, and the 4th root of $\overline{37-20}$ is $\sqrt[4]{\overline{37-20}}$, &c.

A TABLE OF POWERS.

| | | | | | | | | | |
|-----------|---|------|-------|---------|---------|----------|-----------|------------|------------|
| 1st Pow. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2d Pow. | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 |
| 3d Pow. | 1 | 8 | 27 | 64 | 125 | 216 | 343 | 512 | 729 |
| 4th Pow. | 1 | 16 | 81 | 256 | 625 | 1296 | 2401 | 4096 | 6561 |
| 5th Pow. | 1 | 32 | 243 | 1024 | 3125 | 7776 | 16807 | 32768 | 59049 |
| 6th Pow. | 1 | 64 | 729 | 4096 | 15625 | 46656 | 117649 | 262144 | 531441 |
| 7th Pow. | 1 | 128 | 2187 | 16384 | 78125 | 279936 | 823543 | 2097152 | 4782969 |
| 8th Pow. | 1 | 256 | 6561 | 65536 | 390625 | 1679616 | 5764801 | 16777216 | 43046721 |
| 9th Pow. | 1 | 512 | 19683 | 262144 | 1953125 | 10077696 | 40353607 | 134217728 | 387420489 |
| 10th Pow. | 1 | 1024 | 59049 | 1048576 | 9765625 | 60466176 | 282475249 | 1073741824 | 4386784401 |

THE EXTRACTION OF THE SQUARE ROOT.

RULE.

1. Distinguish the given number into periods of two figures each, by putting a point over the place of units, another over the place of hundreds, and so on, which points show the number of figures the root will consist of.

2. Find the greatest square number in the first or left hand period, place the root of it at the right hand of the given number, (after the manner of a quotient in division) for the first figure of the root, and the square number under the period, and subtract it therefrom, and to the remainder bring down the next period for a dividend.

3. Place the double of the root already found, on the left hand of the dividend for a divisor.

4. Seek how often the divisor is contained in the dividend (except the right hand figure) and place the answer in the root for the second figure of it, and likewise on the right hand of the divisor. Multiply the divisor with the figure last annexed by the figure last placed in the root, and subtract the product from the dividend. To the remainder join the next period for a new dividend.

5. Double the figures already found in the root for a new divisor, (or bring down your last divisor for a new one, doubling the right hand figure of it) and from these find the next figure in the root as last directed, and continue the operation in the same manner, till you have brought down all the periods.

NOTE 1st.—If, when the given power is pointed off as the power requires, the left hand period should be deficient, it must nevertheless stand as the first period.

NOTE 2d.—If there be decimals in the given number, it must be pointed both ways from the place of units. If, when there are integers, the first period in the decimals be deficient, it may be completed by annexing so many ciphers as the power requires. And the root must be made to consist of so many whole numbers and decimals as there are periods belonging to each; and when the periods belonging to the given numbers are exhausted, the operation may be continued at pleasure by annexing ciphers.

EXAMPLES.

1. What is the square root of 576?

$$\begin{array}{r} 576(24 \\ 400 \\ \hline 44)176 \\ 176 \end{array}$$

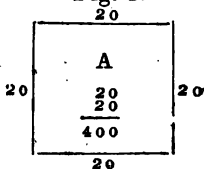
To illustrate this example, we will suppose a man has 576 square yards of carpeting, and he wishes to know what would be the length of one side of a square room, the floor of which his carpet would cover.

If we find a number multiplied by itself, that will produce 576, that number will be the side of a square room, which will contain 576 square yards, and will be the square root of that number; for the square root of any number, by the definition, is, that which, if multiplied by itself, will produce the number. We perceive that our number (576) consists of three figures; therefore, there will be two figures in the root; for the product of any two numbers can have at most but just so many figures as there are in both factors, and, at least, but one less. By the table, we find the greatest square number in the left hand period 5, is 4; and that its root is 2, which we place in the quotient. As this 2 is in the place of tens, its value must be 20, and its square 400. Let this be represented by a square, whose side is 20 yards, and whose contents are 400 yards.

See figure A. We now subtract 400 from 576, and there remains 176. Now the square A must be so enlarged by the addition of the 176 yards, that it shall continue to be a perfect square. And this can be effected only by enlarging two of the sides.

We therefore double the root 20, one of the sides, and it gives the length of the two sides to be enlarged; viz. 40. We then inquire how many times 40, as a divisor, is contained in the dividend (except the right hand figure,) and find it to be 4 times; this we place in the root, and also in the divisor. This 4 is the breadth of the addition to the square, and this breadth multiplied by the length of the two additions (40,) gives the contents of the two figures C and D, 160, which is 80 for each. There now remains the figure E

Fig. 1.



to complete the square, the side of which is 4, it being equal to the breadth of the additions C and D; therefore, if we square 4, we have the contents of the last addition, 16. It is on account of this last addition, that the last figure of the root is placed in the divisor. If we now multiply the divisor by the last figure in the root, the product will be 176, which is equal to the three additions to the square C, D, E. Consequently, figure 2 exhibits the dimension of a room 24 yards square, the floor of which will contain 576 square yards of carpeting.

Fig. 2.

| | | | |
|----|-----------------|----|---------------|
| 20 | | 4 | |
| C | $\frac{20}{4}$ | E | $\frac{4}{4}$ |
| | 80 | | 16 |
| B | | D | |
| 20 | $\frac{20}{20}$ | 20 | $\frac{4}{4}$ |
| | 400 | | 80 |
| 20 | | 20 | |

| | |
|------------|-----|
| B contains | 400 |
| C " | 80 |
| D " | 80 |
| E " | 16 |

Proof. 576

or,
24 × 24 = 576

2. What is the square root of 278784 ?

278784(528 Answer.

25

102)287

204

1048) 8384

8384

3. What is the square root of 776161 ? Ans. 881.
4. What is the square root of 806404 ? Ans. 898.
5. What is the square root of 998001 ? Ans. 999.
6. What is the square root of 10342656 ? Ans. 3216.
7. What is the square root of 9645192360241 ? Ans. 3105671.
8. Extract the square root of 234.09. Ans. 15.3.
9. Extract the square root of .000729. Ans. .027.

10. Required the square root of 17.3056. Ans. 4.16
 11. Required the square root of 373. Ans. 19.3132079+.
 12. Required the square root of 8.93. Ans. 2.98831056+.
 13. What is the square root of 1.96? Ans. 1.4
 14. Extract the square root of 3.15. Ans. 1.77482393+.
 15. What is the square root of 572190960721? Ans. 756439.

If it be required to extract the square root of a vulgar fraction, reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and of the denominator for a new denominator; or reduce the vulgar fraction to a decimal, and extract its root.

16. What is the square root of $1\frac{11}{16}$? Ans. $1\frac{1}{4}$.
 17. What is the square root of $2\frac{7}{16}$? Ans. $1\frac{1}{2}$.
 18. What is the square root of $42\frac{1}{4}$? Ans. $6\frac{1}{2}$.
 19. What is the square root of $52\frac{9}{16}$? Ans. $7\frac{1}{4}$.
 20. What is the square root of $95\frac{1}{16}$? Ans. $9\frac{1}{4}$.
 21. What is the square root of $363\frac{1}{16}$? Ans. $19\frac{1}{4}$.
 22. Extract the square root of $6\frac{3}{4}$. Ans. 2.5298+.
 23. Extract the square root of $8\frac{1}{4}$. Ans. 2.9519+.
 24. Required the square root of 2. Ans. 1.41421+.

APPLICATION OF THE SQUARE ROOT.

The following propositions are demonstrably true.

Circles are to each other, as the squares of their diameter.

In a right-angled triangle, the square of the longest side is equal to the sum of the squares of the other two sides.

25. A certain general has an army of 141376 men. How many must he place in rank and file to form them into a square? Ans. 376.

26. If the area of a circle be 1760 yards, how many feet must the side of a square measure to contain that quantity?

Ans. 125.857+feet.

27. If the diameter of a round stick of timber be 24 inches, how large a square stick may be hewn from it?

Ans. 16.97+in.

28. I wish to set out an orchard of 2400 mulberry trees, so that the length shall be to the breadth as 3 to 2; and the distance of each tree, one from the other, 7 yards. How many trees must be in length, and how many in breadth; and how many square yards of ground do they stand on?

| | | |
|-------------------|--------|-----------|
| Trees in length, | 60 | } Answer. |
| Trees in breadth, | 40 | |
| Square yards, | 112749 | |

29. If a lead pipe, $\frac{3}{4}$ of an inch in diameter, will fill a cistern in 3 hours, what should be its diameter to fill it in 2 hours?

Ans. .918+in.

30. If a pipe $1\frac{1}{2}$ inches in diameter will fill a cistern in 50 minutes; how long would it require a pipe, that is 2 inches in diameter, to fill the same cistern?

Ans. 28m. $7\frac{1}{2}$ sec.

31. If a pipe, 6 inches in diameter, will draw off a certain quantity of water in 4 hours; in what time would it take 3 pipes, of four inches in diameter, to draw off twice the quantity?

Ans. 6 hours.

32. If a line, 144 feet long, will reach from the top of a fort to the opposite side of a river, that is 64 feet wide; what is the height of the fort?

Ans. 128.99+.

33. A certain room is 20 feet long, 16 feet wide, and 12 feet high; how long must be a line to extend from one of the lower corners to an opposite upper corner?

Ans. 28.28ft.

34. Two ships sail from the same port; one goes due north, 128 miles, the other due east, 72 miles; how far are the ships from each other?

Ans. 146.86+.

35. There are two columns in the ruins of Persepolis, left standing upright; one is 70 feet above the plane, and the other 50; in a straight line between these stands an ancient small statue, 5 feet in height; the head of which is 100 feet from the summit of the higher, and 80 feet from the top of the lower column. Required the distance between the tops of the two columns.

Ans. 143.536+ft.

36. The height of a tree, growing in the centre of a circular island, 100 in diameter is 160 feet; and a line extending from the top of it to the further shore is 400 feet. What is the breadth of the stream, provided the land on each side of the water be level?

Ans. 316.6+ft.

37. A ladder 70 feet long is so planted as to reach a window 40 feet from the ground, on one side of the street, and without moving it at the foot, will reach a window 30 feet high on the other side; what is the breadth of the street?

Ans. 120.69+ft.

38. If an iron wire, $\frac{1}{16}$ inch in diameter, will sustain a weight of 450 pounds; what weight might be sustained by a wire an inch in diameter? Ans. 45000lbs.

39. Suppose a tree to stand on a horizontal plane 80 feet in height; at what height from the ground must it be cut off, so that the top of it may fall on a point 40 feet from the bottom of the tree, the end where it was cut off resting on the stump? Ans. 30ft.

40. Four men, A, B, C, D bought a grindstone, the diameter of which was 4 feet; they agreed that A should grind off his share first, and that each man should have it alternately until he had worn off his share; how much will each man grind off? Ans. A 3.22+, B 3.81+, C 4.96+, D 12in.

NOTE.—If the diameter of a circle be multiplied by 3.14159, the product is the circumference.

If the square of the diameter be multiplied by .785398, the product is an inscribed square.

If half the circumference of a circle be multiplied by half the diameter, the product is the contents.

If the area of a circle be divided by .785398, the quotient is the square of the diameter.

41. What is the length of a rope that must be tied to a horse's neck, that he may feed on an acre? Ans. 7.136+rods.

42. I have a garden in a circular form, that contains 100 square rods; how large an enclosure, exactly square, can be made in it? Ans. 7.97+rods.

EXTRACTION OF THE CUBE ROOT.

A cube is a regular body, with six equal sides.

A number is said to be cubed, when it is multiplied into its square.

To extract the cube root, is to find a number, which, multiplied into its square, will produce the given number.

RULE.

1. Separate the given number into periods of three figures each, by putting a point over the unit figure, and every third figure beyond the place of units.

2. Find by the table the greatest cube in the left hand period, and put its root in the quotient.

3. Subtract the cube thus found, from this period, and to the remainder bring down the next period; call this the *dividend*.

4. Multiply the square of the quotient by 300, calling it the triple square; multiply also the quotient by 30, calling it the *triple quotient*; the sum of these call the *divisor*.

5. Find how many times the divisor is contained in the dividend, and place the result in the quotient.

6. Multiply the triple square by the last quotient figure, and write the product under the dividend; multiply the square of the last quotient figure by the triple quotient, and place this product under the last; under all, set the cube of the last quotient figure, and call their sum the *subtrahend*.

7. Subtract the subtrahend from the dividend, and to the remainder bring down the next period for a new dividend, with which proceed as before, and so on, till the whole is completed.

NOTE.—The same rule must be observed for continuing the operation, and pointing for decimals, as in the square root.

To illustrate this rule, let us suppose we had 46.656 cubic blocks of granite, which measure 1 foot on each side. With these we are to erect a cubical monument. It is required to ascertain how many blocks or feet will be the length of one side.

It is evident that the number must be equal to the cube root of 46.656. As the given number consists of two periods, the root will consist of two planes. We find by the table of powers, that the greatest power in the left hand period, 46 (thousand,)

Operation.

46.656(36

27

19656

16200

3240

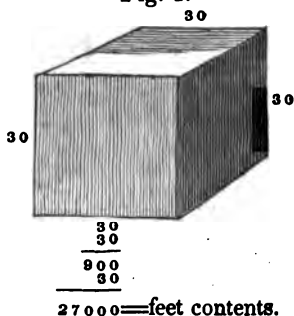
216

19656

is 27 (thousand,) the root of which is 3. This we place in the quotient; and as it will occupy the place of *tens*, its real value is 30. If this be considered the side of a cube, it will contain 27.000 cubic feet, $30 \times 30 \times 30 = 27.000$. See fig. 1. From 46.656 we take 27.00, and there remain 19.656 cubic feet; that is, we should subtract the cube of the quotient from the first period, and to the remainder we should bring down the next period. (See

operation.) The cubic feet or blocks that remain must be applied to three sides of the monument; for, unless a cube be equally increased on *three* sides, it ceases to be a cube. To effect this, we must find the superficial contents of three sides

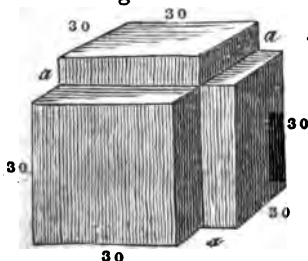
Fig. 1.



of the cube, and with this divide the remaining number of feet or blocks. As the length of a side is 30, the superficial contents will be $30 \times 30 = 900$; and this multiplied by 3, will give the whole surface of the sides, $900 \times 3 = 2700$. * With this, as a divisor, we inquire how many times it is contained in 19656, and find it to be 6 times, (one or two units are generally to be allowed on account of the other deficiencies in enlarging the cube.) This 6 is the thickness of the three ad-

ditions to the cube, and by multiplying their superficial contents by it, we have the amount of the additions to be made, $2700 \times 6 = 16200$; that is, *we multiply the triple square by the last quotient figure*. See operation.

Fig. 2.



Having applied these additions to our cube, we find there are three other deficiencies, (see figure 2); the length of each being equal to that of the additions, 30; and the height and breadth of each, are equal to the thickness of the addition, 6. To find the contents of these, we multiply the product of their length, breadth and thickness by their number,

$3 \times 6 \times 30 \times 3 = 3240$. Or, which is the same thing, *we multiply the triple quotient by the square of the last quotient figure*, $6 \times 6 \times 30 = 3240$. Having made these additions to the cube,

It is not necessary, that the *triple quotient* should be added to form a isor.

Fig. 3.

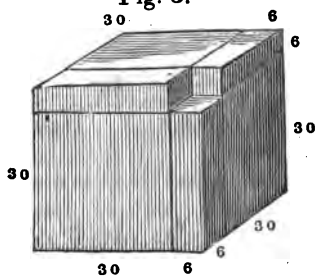
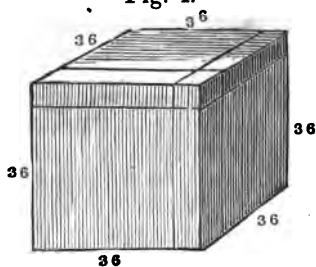


Fig. 4.



we still find one other deficiency, (see figure 3,) the length, breadth and thickness of which is equal to the thickness of the former additions; viz. 6. The contents of this may be found by multiplying its length, breadth and thickness together; that is, *cubing the last quotient figure*, $6 \times 6 \times 6 = 216$. By making this last addition, we find that our cubical monument is finished; (see figure 4) and that the first figure together with the several additions, is equal to the cubical blocks, 46.656.

27000=contents of fig. 1.

16200=first addition.

3240=second addition.

216=third addition.

46656=contents of the whole monument.

EXAMPLES.

1. Required the cube root of 77308776.

| | |
|--|---|
| $\begin{array}{r} 77308776 \text{ (426 root.)} \\ 64 \\ \hline 4920 \overline{) 13308} = \text{1st dividend.} \\ \hline 9600 \\ 480 \\ 8 \\ \hline 10088 = \text{1st subtrahend. 1st subtrahend} = 10088 \\ \hline 530460 \overline{) 3220776} = \text{2d dividend.} \\ \hline 3175200 \\ 45360 \\ 216 \\ \hline 3220776 = \text{2d sub'd.} \end{array}$ | $\begin{array}{r} 4 \times 4 \times 300 = 4800 \\ 4 \times 30 = 120 \\ \hline \text{1st divisor} = 4920 \\ \hline 4800 \times 2 = 9600 \\ 120 \times 2 \times 2 = 480 \\ 2 \times 2 \times 2 = 8 \\ \hline 529200 \times 6 = 3175200 \\ 1260 \times 6 \times 6 = 45360 \\ 6 \times 6 \times 6 = 216 \\ \hline \text{2d subtrahend} = 3220776 \end{array}$ |
|--|---|

2. What is the cube root of 34965783 ? Ans. 327.
3. What is the cube root of 436036824287 ? Ans. 7583.
4. What is the cube root of 84.604519 ? Ans. 4.39.
5. Required the cube root of 54439939. Ans. 379.
6. Extract the cube root of 60236288. Ans. 392.
7. Extract the cube root of 109215352. Ans. 478.
8. What is the cube root of 116.930169 ? Ans. 4.89.
9. What is the cube root of .726572699 ? Ans. .899.
10. Required the cube root of 2. Ans. 1.2599. +
11. Find the cube root of 11. Ans. 2.2239. +
12. What is the cube root of 122615327232 ? Ans. 4968.
13. What is the cube root of $\frac{125}{8}$? Ans. $\frac{5}{2}$.
14. What is the cube root of $\frac{125}{8}$? Ans. $\frac{5}{2}$.
15. What is the cube root of $\frac{125}{8}$? Ans. $\frac{5}{2}$.
16. What is the cube root of $\frac{125}{8}$? Ans. $\frac{5}{2}$.

APPLICATION OF THE CUBE ROOT.

Principles assumed.

Spheres are to each other, as the cubes of their diameter.

Cubes and all *similar* solid bodies, are to each other, as the cubes of their diameter, or *homologous* sides.

17. If a ball, 3 inches in diameter, weigh 4 pounds, what will be the weight of a ball that is 6 inches in diameter?

Ans. 32lbs.

18. If a cube of gold 1 inch in diameter, is worth \$120, what is the value of a globe $3\frac{1}{2}$ inches in diameter?

Ans. \$5133.

19. If the weight of a well-proportioned man, 5 feet 10 inches in height, be 180 pounds, what must have been the weight of Goliath of Gath, who was 10 feet $4\frac{3}{4}$ inches in height?

Ans. 1012 $\frac{1}{2}$ lbs.

20. If a bell, 4 inches in height, 3 inches in width, and $\frac{1}{4}$ of an inch in thickness, weigh 2 pounds, what should be the dimensions of a bell that would weigh 2000 pounds?

Ans. 3ft. 2in. high, 2ft. 6in. wide, and $2\frac{1}{4}$ in. thick.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

RULE.

1. Prepare the given number for extraction, by pointing off from the units' place, as the required root directs.

2. Find the first figure of the root by trial, or by inspection, in the table of powers, and subtract its power from the left hand period.

3. To the remainder, bring down the first figure in the next period, and call it the *dividend*.

4. Involve the root to the next inferior power to that which is given, and multiply it by the number denoting the given power for a *divisor*.

5. Find how many times the divisor is contained in the dividend, and the quotient will be another figure of the root.

6. Involve the whole root to the given power, and subtract it from the *given number*, as before.

7. Bring down the first figure of the next period to the remainder for a new dividend, to which find a new divisor, as before; and in like manner proceed till the whole is finished.

EXAMPLES.

1. What is the cube root of 20346417?

$$\begin{array}{rcl}
 & 20346417 & (273 \\
 2^3 = & 8 & = 1^{\text{st}} \text{ subtrahend.} \\
 \hline
 2^3 \times 3 = & 12 &) 123 \\
 \hline
 27^3 = & 19683 & = 2^{\text{d}} \text{ subtrahend.} \\
 \hline
 273^3 \times 3 = & 2187 &) 6634 \\
 \hline
 273^3 = & 20346417 & = 3^{\text{d}} \text{ subtrahend.}
 \end{array}$$

2. What is the fourth root of 34827998976?

Ans. 431.9⁺.

3. What is the fourth root of 2819506221875? Ans. 195.

4. Required the sixth root of 1178420166015625.

Ans. 325.

5. Required the seventh root of 1283918464548864.

Ans. 144.

6. Required the seventh root of 218340105584896.

Ans. 62.

ARITHMETICAL PROGRESSION. *

When a series of quantities, or numbers, increase or decrease by a constant difference, it is called arithmetical progression or progression by difference. The constant difference is called the *common difference*, or *ratio* of the progression.

Thus, let there be the two following series,—

$$\begin{array}{l}
 1, 5, 9, 13, 17, 21, 25, 29, 33, \\
 25, 22, 19, 16, 13, 10, 7, 4, 1.
 \end{array}$$

* As a demonstration of this rule is so much better understood by Algebra than Arithmetic, the author has thought best to omit it.

The first is called an ascending series, or progression. The second is called a descending series, or progression.

The numbers which form the series, are called the *terms* of progression.

The first and last terms of a progression, are called the *extremes*, and the other terms, the *means*.

Any three of the five following things being given, the other two may be found.

1. The first term.
2. The last term.
3. The number of terms.
4. The common difference.
5. The sum of the terms.

PROBLEM I.

The first term, last term, and the number of terms being given, to find the common difference.

RULE.—Divide the difference of the extremes by the number of terms, and the quotient is the common difference.

EXAMPLES.

1. The extremes are 3 and 45, and the number of terms is 22. What is the common difference?

$$\begin{array}{r} 45-3 \\ \hline 22-1 \end{array} = 2 \text{ Answer.}$$

2. A man is to travel from Boston to a certain place, in 11 days, and to go but 5 miles the first day, increasing every day by an equal increase, so that the last day's journey may be 45 miles. Required the daily increase. Ans. 4 miles.

3. A man had 10 sons, whose several ages differed alike; the youngest was 3 years, and the oldest 48. What was the common difference of their ages? Ans. 4 years.

4. A certain school consists of 19 scholars; the youngest is 3 years old, and the oldest 39. What is the common difference of their ages? Ans. 2 years.

PROBLEM II.

The first term, the last term, and the number of terms given, to find the sum of all the terms.

RULE.—Multiply the sum of the extremes by the number of terms, and half the product will be the sum.

EXAMPLES.

5. The extremes of an arithmetical series are 3 and 45, and the number of terms 22. Required the sum of the series.

$$\frac{45+3 \times 22}{2} = 504 \text{ Answer.}$$

6. A man going a journey, travelled the first day 7 miles, the last day 51 miles, and each day increased his journey 4 miles. How far did he travel? Ans. 348 miles.

7. In a certain school there are 19 scholars; the youngest is 3 years old, and the oldest 39. What is the sum of their ages? Ans. 399 years.

8. Suppose a number of stones were laid a rod distant from each other, for 30 miles, it being the distance from Boston to Haverhill; and the first stone a rod from a basket. What length of ground will that man travel over who gathers them up singly, returning with them one by one to the basket? Ans. 900 miles, 30rds.

PROBLEM III.

Given the extremes and the common difference, to find the number of terms.

RULE.—Divide the difference of the extremes by the common difference, and the quotient increased by one, will be the number of terms required.

EXAMPLES.

9. If the extremes are 3 and 45, and the common difference 2, what is the number of terms?

$$\frac{45-3}{2} + 1 = 22 \text{ Answer.}$$

10. In a certain school where the ages of the scholars all differ alike; the oldest is 39 years old, and the youngest is 3 years, and the difference between the ages of each is 2 years. Required the number of scholars? Ans. 19 scholars.

11. A man going a journey, travelled the first day 7 miles, and the last day 51 miles, and each day increased his journey by 4 miles. How many days did he travel, and how far? Ans. 12 days, and 348 miles.

PROBLEM IV.

The extremes and common difference given, to find the sum of all the series.

RULE.—Multiply the sum of the extremes by their difference, increased by the common difference, and the product divided by twice the common difference will give the sum.

12. If the extremes are 3 and 45, and the common difference 2, what is the sum of the series? Ans. 528.

13. A owes B a certain sum, to be discharged in a year, by paying 6 cents the first week, and 18 cents the second week, and thus to increase every week by 12 cents till the last payment should be \$6.18. What is the debt? Ans. \$162.24.

PROBLEM V.

The extremes and sum of the series given, to find the common difference.

RULE.—Divide the product of the sum of the differences of the extremes, by the difference of twice the sum of the series, and the sum of the extremes, and the quotient will be the common difference.

EXAMPLES.

14. The extremes are 3 and 45, and the sum of the series 528. What is the common difference? Ans. 2.

PROBLEM VI.

Given the first term, number of terms, and the sum of the series, to find the last term.

RULE.—Divide twice the sum by the number of terms, from the quotient take the first term, and the remainder will be the last.

EXAMPLES.

15. A merchant being indebted to 21 creditors \$504, ordered his clerk to pay the first \$3, and the rest increasing in arithmetical progression. What is the difference of the payments, and the last payment?

Ans. 2 difference. \$45 last payment.

GEOMETRICAL SERIES.

If there be three or more numbers, and if there be the same quotient, when the second is divided by the first, and the third divided by the second, and the fourth divided by the third, &c. those numbers are in *geometrical progression*. If the series *increase*, the quotient is more than unity, if it *decrease*, it is less than unity.

The following series are examples of this kind.

| | | | | | |
|-----|-----|-----|-----|------|-----|
| 2, | 6, | 18, | 54, | 162, | 486 |
| 64, | 32, | 16, | 8, | 4, | 2 |

The former is called an ascending series, and the latter a descending series.

In the first, the quotient is 3, and is called the *ratio*; in the second, it is $\frac{1}{2}$.

The first and last terms of a series are called *extremes*, and the other terms *means*.

PROBLEM I.

Given one of the extremes, the ratio, and number of terms, to find the other extreme.

RULE.—Multiply or divide, (as the circumstances may require,) the given extreme by such power of the ratio, whose exponent is equal to the number of terms less 1; and the product, or quotient, will be the other extreme.

But as the last term, or any term near the last, is very tedious to be found by continual multiplication, it will often be necessary, in order to ascertain it, to have a series of numbers in Arithmetical Proportion, called *indices*, or *exponents*, beginning either with a cypher, or an unit, whose common difference is *one*. When the *first* term of the series and *ratio* are *equal*, the *indices* must begin with an unit, and, in this case, the product of any two terms, is equal to that term, signified by the *sum* of their *indices*.

Thus $\begin{cases} 1 & 2 & 3 & 4 & 5 & 6 & \&c. \text{ indices or arithmetical series.} \\ 2 & 4 & 8 & 16 & 32 & 64 & \&c. \text{ geometrical series.} \end{cases}$

Now $6+6=12$ —the index of the twelfth term, and $64 \times 64 = 4096$ —the twelfth term.

But, when the *first* term of the series and the *ratio* are *different*, the *indices* must begin with a cipher, and the sum of the *indices* made choice of, must be *one less* than the *number of terms* given in the question; because 1 in the *indices* stands over the *second term*, and 2 in the *indices* over the *third term*, &c. And, in this case, the *product* of any *two terms*, divided by the *first*, is equal to that term *beyond* the first, signified by the sum of their *indices*.

Thus $\begin{cases} 0 & 1 & 2 & 3 & 4 & 5 & 6 & \&c. \text{ indices.} \\ 1 & 3 & 9 & 27 & 81 & 243 & 729 & \&c. \text{ geometrical series.} \end{cases}$

Here $6+5=11$, the index of the 12th term.

$729 \times 243 = 177147$, the 12th term, because the first term of the series and ratio are different, by which means a cipher stands over the first term.

Thus by the help of these *indices*, and of few of the first terms in any geometrical series, any term, whose distance from the first term is assigned, though it were ever so remote, may be obtained without producing all the terms.

EXAMPLES.

1. If the first term be 4, the ratio 4, and the number of terms 9, what is the last term?

$$1. \quad 2. \quad 3. \quad 4. \quad + \quad 4 = 8$$

4. 16. 64. $256 \times 256 = 65536$ = power of the ratio, whose exponent is less by 1, than the number of terms. 65536×4 the first term = 262144 = last term.

Or, $4 \times 4^8 = 262144$ = last term, as before.

2. If the last term be 262144, the ratio 4, and the number of terms 9, what is the first term?

$$4^8 = 65536) 262144 (4 = \text{the first term.}$$

3. If the last term is 72, the ratio 3, and the number of terms 6, what is the first term? Ans. $\frac{8}{27}$.

4. If I were to buy 30 oxen, and to give 2 cents for the first ox, and 4 cents for the second, 8 cents for the third, &c., what would be the price of the last ox? Ans. \$10737418.24.

5. If the first term be 5, the ratio 3, what is the seventh term? Ans. 3645.

PROBLEM II.

Given the first term, the ratio, and the number of terms, to find the sum of the series.

RULE.—Find the last term, as before, multiply it by the ratio, and from the product subtract the first term. Divide the remainder by the ratio less 1, and the quotient will be the answer.

Or, raise the ratio to a power, whose index shall be equal to the number of terms; from which subtract 1; divide the remainder by the ratio less 1, and the quotient, multiplied by the first term, will give the sum of the series.

EXAMPLES.

6. If the first term be 10, the ratio 3, and the number of terms 7; what is the sum of the series?

$$\frac{3^7 - 1}{3 - 1} \times 10 = 10930 \text{ Answer.}$$

7. How large a debt can be discharged in a year, by paying \$1 the first month, \$10 the second, and so on, in a ten-fold proportion, each month? **Ans. 11111111111.**

8. A gentleman offered a house for sale, on these moderate terms; that, for the first door, he should charge 10 cents, for the second 20 cents, for the third 40 cents, and so on in a geometrical ratio; there being 40 doors. What was the price of the house? **Ans. \$109951162777.50.**

9. If the first term be 50, the ratio 1.06, and the number of terms 4, what is the sum of the series? **Ans. 63.1239+.**

10. What is the compound interest of \$160.00 for 6 years, at 6 per cent.? **Ans. \$226.96.3+.**

11. What is the compound interest of \$300.00 for 8 years, at 5 per cent.? **Ans. \$443.23.6+.**

12. If one mill had been put at interest at the commencement of the Christian era, what would it amount to at compound interest, supposing the principle to have doubled itself every 12 years, January 1, 1837?

Ans. \$1427247692705959881058285969449495136382746.624

If this sum was all in dollars, it would take the present inhabitants of the globe more than 1,000,000 years to count it. If it was reduced to its value in pure gold, and was formed into a globe, it would be many millions times larger than all the bodies that compose the solar system.

DISCOUNT BY COMPOUND INTEREST.

RULE.

Divide the debt by that power of the amount of one dollar for one year, denoted by the time, and the quotient will be the present worth, which subtracted from the debt, will leave the discount.

EXAMPLE.

1. What is the present worth of \$600, due 3 years hence, at 6 per cent. compound interest?

$$1.06|^3 = 1.19101 \quad 600.00000 (\$503.770.4 \text{ Answer.})$$

2. What is the present worth of \$500.00, due 4 years hence, at 6 per cent. compound interest? Ans. \$396.04.6+.
3. What is the present worth of \$1000.00, due 10 years hence, at 5 per cent. compound interest. Ans. \$613.91.3+.
4. What is the discount on \$800.00, due 2 years hence, at 6 per cent. compound interest? Ans. \$88.00.3+.

Annuities at Compound Interest.

An annuity is a certain sum of money to be paid at regular periods, either for a limited time or forever.

To find the amount of an annuity, at compound interest.

RULE.—Make \$1.00 the first term of a geometrical series, and the amount of \$1.00, at the given rate per cent., the ratio. Carry the series to so many terms as the number of years, and find its sum.

Multiply the sum thus found by the given annuity, and the product will be the amount.

EXAMPLES.

5. What will an annuity of \$60 per annum, payable yearly, amount to in 4 years, at 6 per cent.?

$$1 + 1.06 + \overline{1.06}^2 + \overline{1.06}^3 = 4.374616$$

$$4.374616 \times 60 = \$262.47.6 + \text{Answer.}$$

6. What will an annuity of \$500.00 amount to in 5 years, at 6 per cent.? Ans. \$2818.54.6+.
7. What will an annuity of \$1000.00, payable yearly, amount to in 10 years? Ans. \$13180.79.4+.
8. What will an annuity of \$30.00, payable yearly, amount to in 3 years? Ans. \$95.50.8+.

ALLIGATION.

Alligation teaches how to compound or mix together several simples of different qualities, so that the composition may be of some intermediate quality or rate. It is of two kinds, Alligation Medial and Alligation Alternate.

ALLEGATION MEDIAL.

Alligation Medial teaches how to find the mean price of several articles mixed, the quantity and value of each being given.

RULE.

As the sum of the quantities to be mixed is to their value, so is any part of the composition to its mean price.

EXAMPLES.

1. A grocer mixed 2 cwt. of sugar, at \$9.00 per cwt., and 1 cwt., at \$7.00 per cwt., and 2 cwt. at \$10.00 per cwt.; what is the value of 1 cwt. of this mixture?

| | | |
|--------------------|---|----------------------------------|
| 2 cwt., at 9.00 | = | 18.00 |
| 1 7.00 | = | 7.00 |
| 2 10.00 | = | 20.00 |
| <hr/> | | <hr/> |
| 5 | : | 45.00 :: 1 cwt. : \$9.00 Answer. |

2. If 19 bushels of wheat, at \$1.00 per bushel, be mixed with 40 bushels of rye, at \$0.66 per bushel, and 11 bushels of barley, at \$0.50 per bushel; what is a bushel of this mixture worth?

Ans. \$0.72.74.

3. If 3 pounds of gold, of 22 carats fine, be mixed with 3 pounds, of 20 carats fine; what is the fineness of the mixture?

Ans. 21 carats.

4. If I mix 20 pounds of tea, at 70 cents per pound, with 15 pounds, at 60 cents per pound, and 80 pounds, at 40 cents per pound; what is the value of 1 pound of this mixture?

Ans. \$0.47 $\frac{1}{2}$.

NOTE.—If an ounce, or any other quantity of pure gold, be divided into 24 equal parts; these parts are called *carats*. But gold is often mixed with some baser metal, which is called the *alloy*; and the mixture is said to be so many carats fine, according to the proportion of pure gold contained in it; thus, if 22 carats of pure gold, and 2 of alloy be mixed together, it is said to be 22 carats fine.

ALLEGATION ALTERNATE.

This rule teaches us how, from the prices of several articles given, to find how much of each must be mixed, to bear a certain price.

CASE I.

RULE. Place the prices under each other, in the order of their value; connect the price of each ingredient, which is less in value, than the intended compound, with one, which is of greater value than the compound. Place the difference between the price and that of each simple, opposite to the price with which they are connected.

EXAMPLES.

5. A merchant has spices, some at 18 cents a lb., some at 24 cents, some at 48 cents, and some at 60 cents. How much of each sort must he mix that he may sell the mixture at 40 cents a lb.?

| | cts. | lbs. | cts. | |
|--------------|------|------|-------|---------|
| Mean rate 40 | 18 | 20 | at 18 | Answer. |
| | 24 | 8 | " 24 | |
| | 48 | 16 | " 48 | |
| | 60 | 22 | " 60 | |

| | cts. | lbs. | cts. | |
|--------------|------|------|-------|---------|
| Mean rate 40 | 18 | 8 | at 18 | Answer. |
| | 24 | 20 | " 24 | |
| | 48 | 22 | " 48 | |
| | 60 | 16 | " 60 | |

| | cts. | | lbs. | lbs. | lbs. | cts. | |
|--------------|------|---|------|------|------|------|---------|
| Mean rate 40 | 18 | } | 20 | + | 8 | 28 | at 18 |
| | 24 | | 20 | + | 8 | 28 | " 24 |
| | 48 | | 22 | + | 16 | 38 | " 48 |
| | 60 | | 22 | + | 16 | 38 | " 60 |
| | | | | | | | Answer. |

The various answers arise from the different ways of connecting the rates of the ingredients. Almost every question will admit of seven different ways of connecting, and will produce as many answers; and by increasing the answers of any one question *proportionally*, an indefinite number of answers might be produced.

NOTE.—By connecting the less rate with the greater, and placing the difference between them and the mean rate, alternately, the quantities are such, that there is precisely as much gained by one quantity, as is lost by the other; and, therefore, the *gain* and *loss* upon the whole are equal, and are precisely the *proposed rate*.

6. How much barley, at 50 cents a bushel, and rye, at 75 cents, and wheat, at \$1.00, must be mixed, that the composition may be worth 80 cents a bushel?

Ans. 20 bushels of rye, 20 of barley, and 35 of wheat.

7. A goldsmith would mix gold, of 19 carats fine, with some of 15, 23, and 24 carats fine, that the compound may be 20 carats fine. What quantity of each must he take?

Ans. 4oz. of 15 carats, 3oz. of 19, 1oz. of 23, and 5oz. of 24.

8. It is required to mix several sorts of wine, at 60, 80 cents, and \$1.20, with water, that the mixture may be worth 75 cents per gallon; how much of each sort must be taken?

Ans. 45gals. of water, 5gals. of 60 cents, 15gals. of 80 cents, and 75gals. \$1.20.

CASE II.

When one of the ingredients is limited to a certain quantity.

RULE.—Take the difference between each price, and the mean rate as before; then say, as the difference of that simple, whose quantity is given, is to the rest of the differences severally; so is the quantity given, to the several quantities required.

EXAMPLES.

9. How much wine, at 5s., at 5s. 6d. and 6s. a gallon, must be mixed with 3 gallons, at 4s. per gallon, so that the mixture may be worth 5s. 4d. per gallon?

$$\begin{array}{rcl}
 64 \left\{ \begin{array}{l} 48 \\ 60 \\ 66 \\ 72 \end{array} \right. & \begin{array}{l} 8-2=10 \\ 8-2=10 \\ 16-4=20 \\ 16-4=20 \end{array} & \begin{array}{l} \text{Then } 10:10::3:3 \\ 10:20::3:6 \\ 10:20::3:6 \end{array}
 \end{array}$$

Ans. 3gals. at 5s., 6 at 5s. 6d., and 6 at 6s.

10. A grocer would mix teas, at 12s., 10s., and 6s. per pound, with 20 pounds, at 4s. per pound; how much of each sort must he take to make the composition worth 8s. per pound?

Ans. 20lbs. at 4s., 10lbs. at 6s., 10lbs. at 10s., and 20lbs. at 12s.

11. How much Port wine, at \$1.75, and temperance wine, at \$1.25, must be mixed with 20 gallons of water, that the whole may be sold at \$1.00 per gallon?

Ans. 20gals. Port wine, and 20gals. temperance wine.

CASE III.*

When one of the ingredients is limited to a certain quantity.

RULE.—Find an answer as before, by *linking*; then say, as

* To this case belongs that curious case of king Hiero's crown.

Hiero, king of Syracuse, gave orders for a crown to be made of pure gold; but suspecting that the workmen had debased it, by mixing it with silver or copper, he recommended the discovery of the fraud to the famous Archimides, and desired to know the exact quantity of alloy in the crown.

Archimides, in order to detect the imposition, procured two other masses, the one of pure gold, the other of copper, and each of the same weight of the former; and by putting each separately, into a vessel full of water, the quantity of water expelled by them, determined their specific gravities; from which, and their given weights, the exact quantities of gold and alloy in the crown may be determined.

Suppose the weight of each crown to be 10 pounds, and that the water expelled by the copper, was 92 pounds, by the gold 52 pounds, and by the compound crown, 64 pounds; what will be the quantities of gold and alloy in the crown?

The rates of the simples are 92 and 52, and of the compound 64; therefore,

$$\begin{array}{rcl}
 64 \left| \begin{array}{l} 92 \\ 62 \end{array} \right. & \begin{array}{l} 12 \text{ of copper,} \\ 28 \text{ of gold,} \end{array} & \begin{array}{l} 40:10::12 \text{ 3lbs. of copper} \\ 40:10::28 \text{ 7lbs. of gold} \end{array} \left. \vphantom{\begin{array}{l} 92 \\ 62 \end{array}} \right\} \text{Answer.} \\
 \hline
 & 40 &
 \end{array}$$

the sum of the quantities or differences, thus determined, is to the given quantity, so is each ingredient, found by linking to the required quantity of each.

EXAMPLES.

12. How many gallons of water must be mixed with wine, at \$1.50, so as to fill a vessel containing 100 gallons, and that it might be sold at \$1.20 per gallon?

$$\begin{array}{rcl}
 120 \left\{ \begin{array}{l} 0 \text{---} 30 \\ 150 \text{---} 120 \end{array} \right. & \begin{array}{l} \text{gals.} \\ 150 : 100 :: 30 : 20 \text{ water} \\ 150 : 100 :: 120 : 80 \text{ wine} \end{array} & \left. \vphantom{\begin{array}{l} 0 \text{---} 30 \\ 150 \text{---} 120 \end{array}} \right\} \text{Answer.} \\
 \hline
 & 150 &
 \end{array}$$

13. A merchant has sugar, at 8 cents, 10 cents, 12 cents, and 20 cents; with these he would fill a hogshead, that would contain 200 pounds. How much of each kind must he take, that he may sell the mixture at 15 cents per pound?

Ans. 33½ lbs., of 8cts., 10cts., and 12cts., and 100lbs. of 20cts.

14. How much gold, of 15, 17, and 22 carats fine, must be mixed with 5 ounces of 18 carats fine, so that the composition may be 20 carats fine?

Ans. 5oz. of 15, 5oz. of 17, and 25oz. of 22.

PERMUTATIONS AND COMBINATIONS.

The permutation of quantities, is the showing how many different ways the order or position of any given number of things may be changed.

The combination of quantities, is the showing how often a less number of things can be taken out of a greater, and combined together, without considering their places or the order they stand in.

CASE I.

To find the number of permutations or changes, that can be made of any given number of things, all different from each other.

RULE.—Multiply all the terms of the natural series of numbers, from one up to the given number, continually together, and the last product will be the answer required.

EXAMPLES.

1. How many changes may be rung on 6 bells.

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 = 720 \text{ changes Answer.}$$

2. For how many days can 10 persons be placed in a different position at dinner ?

Ans. 3628800.

3. How many changes may be rung on 12 bells, and how long would they be in ringing, supposing 10 changes to be rung in one minute, and the year to consist of 365 days, 5 hours and 49 minutes ?

Ans. 479001600, and 91y. 26d. 22h. 41m.

4. How many changes or variations will the alphabet admit of ?

Ans. 403291461126605635584000000.

CASE II.

Any number of different things being given, to find how many changes can be made out of them, by taking any given number of quantities at a time.

RULE.—Take a series of numbers, beginning at the number of things given, and decreasing by 1, to the number of quantities to be taken at a time; the product of all the terms will be the answer required.

EXAMPLES.

5. How many changes can be rung with 4 bells out of 8 ?

$$8 \times 7 \times 6 \times 5 = 1680 \text{ changes Answer.}$$

6. A butcher wishing to buy some sheep, asked the owner how much he must give him for 20; on hearing his price, he said it was too much; the owner replied, that he should have 20, provided he would give him a cent for each different choice of 10 in 20, to which he agreed. How much did he pay for the 10 sheep, according to the bargain ?

Ans. \$1847.56.

7. How many words can be made with 6 letters out of 24 of the alphabet, admitting a word might be made from consonants?
 Ans. 134596.

CASE III.

To find the compositions of any, in an equal number of sets, the things being all different.

RULE.—Multiply the number of things in every set continually together, and the product will be the answer required.

EXAMPLES.

8. Suppose there are 4 companies, in each of which there are 9 men; it is required to find how many ways 4 men may be chosen, one out of each company.

$$9 \times 9 \times 9 \times 9 = 6551 \text{ Answer.}$$

9. There are 4 companies, in one of which there are 6 men, in another 8, and in each of the other two 9 men. What are the choices, by a composition of 4 men, one out of each company?
 Ans. 3888.

10. How many changes are there in throwing 5 dice?
 Ans. 7776.

11. If the gambler make use of 3 dice, what advantage has he over his opponent?

We will suppose the bet to be on the ace. Then by the rule, there will be $6 \times 6 \times 6 = 216$ different ways which the dice may present themselves, that is with and without an ace. Then, if we exclude the ace-side of the die, there will be 5 sides left, and $5 \times 5 \times 5 = 125$ ways without the ace; there will, therefore, remain only $216 - 125 = 91$ ways, in which there could be an ace. The chance for the gambler, then, is as 125 to 91; that is, out of 216 throws, the probability is, that he will win 125 times, and lose 91 times.

Ans. 125 chances for him, 91 against him.

Corollary. Dishonesty is always connected with gambling.

POSITION.

Position is a method of performing such questions as cannot be resolved by the common direct rules, and is of two kinds, called *single* and *double*.

SINGLE POSITION.

Single position teaches us to resolve those questions, whose results are proportional to their suppositions.

RULE.—Take any number, and perform the same operations with it, as are desirable to be performed in the question. Then say, as the result of the operation is to the position, so is the result in the question to the number required.

EXAMPLES.

1. A school-master being asked how many scholars he had, replied, that if he had as many more as he now had, and half as many more, he should have 200; of how many did his school consist?

| | | |
|---------------------------------|-----|----------------------------|
| Suppose he had | 60 | As 150 : 200 :: 60 |
| Then, as many more | 60 | 60 |
| $\frac{1}{2}$ half as many more | 30 | |
| | 150 | 150)12000(80 scholars Ans. |
| | | 12000 |

By analysis. By having as many more, and half as many more, he must have $2\frac{1}{2}$ times the original number; therefore, by dividing 200 by $2\frac{1}{2}$, we obtain the answer, 80, as before.

NOTE.—Having performed all the following questions, by *position*, the student should then perform them by *analysis*.

2. A person after spending $\frac{1}{3}$ and $\frac{1}{4}$ of his money, had \$60 left, what had he at first? Ans. \$144.

3. What number is that, which being increased by $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the sum shall be 125? Ans. 60.

4. A's age is double that of B, and B's is triple that of C, and the sum of all their ages is 140. What is each person's age? Ans. A's 84, B's 42, C's 14 years.

5. A person lent a sum of money, at 6 per cent., and at the end of 10 years received the amount, \$560. What was the sum lent? Ans. \$350.

6. Seven-eighths of a certain number exceed $\frac{1}{2}$ by 81, what is the number? Ans. 120.

7. What number is that, whose $\frac{3}{4}$ exceeds $\frac{1}{2}$ by $2\frac{1}{4}$? Ans. 87.

DOUBLE POSITION. *

Double Position teaches to resolve questions, by making two suppositions of false numbers.

Those questions in which the results are not proportional to their positions, belong to this rule.

RULE.

Take any two convenient numbers, and proceed with each according to the conditions of the question. Find how much the results are different from the result in the question. Multiply each of the errors by the contra supposition, and find the sum and difference of the products. If the errors are alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer. If the errors are unlike, divide the sum of the products by the sum of the errors, and the quotient will be the answer.

NOTE.—The errors are said to be alike, when they are both too great, or both too small; and unlike, when one is too great and the other too little.

EXAMPLES.

1. A lady purchased a piece of silk for a gown, at 80 cents per yard, and lining for it, at 30 cents per yard; the gown and lining contained 15 yards, and the price of the whole was \$7.00. How many yards were there of each?

| | |
|---|--------|
| Suppose 6 yards of silk, value | \$4.80 |
| She must then have 9 yards of lining, value | 2.70 |
| | <hr/> |
| Sum of their values, | \$7.50 |
| Which should have been | 7.00 |
| | <hr/> |
| So the first error is 50 too much, | + .50 |

* This rule is founded on the supposition, that the first error is to the second, as the difference between the true and first supposed number is to the difference between the true and second supposed number. When this is not the case, the exact answer to the questions cannot be found by this rule.

| | |
|---|--------|
| Again; suppose she had 4 yards of silk, value | \$3.20 |
| Then she must have 11 yards of lining, value | 3.30 |

| | |
|------------------------|--------|
| Sum of their values, | \$6.50 |
| Which should have been | 7.00 |

| | |
|--|-----|
| So that the second error is 50 too little, | —50 |
|--|-----|

| | |
|---|------|
| First supposition multiplied by last error, $6 \times 50 =$ | 3.00 |
| Last supposition multiplied by first error, $4 \times 50 =$ | 2.00 |

| | |
|---|------|
| Add the products, because <i>unlike</i> , | 5.00 |
|---|------|

| | | |
|---|--------|---|
| $500 \div 50 + 50 = 5$ yards of silk, } $15 - 5 = 10$ yards of lining, } | } Ans. | $5 \times 80 = \$4.00$ $10 \times 30 = 3.00$ |
|---|--------|---|

| | |
|--------|--------|
| Proof. | \$7.00 |
|--------|--------|

By analysis. As the silk and lining contains 15 yards, and cost \$7.00, the average price per yard is $46\frac{2}{3}$ cents; and this taken from 80, leaves $33\frac{1}{3}$; and 30 taken from $46\frac{2}{3}$, leaves $16\frac{2}{3}$; and, as the quantity of lining will be to that of the silk, as $33\frac{1}{3}$ to $16\frac{2}{3}$, it is therefore evident, that the quantity of lining is twice the quantity of silk. Wherefore, if 15, the number of yards, be divided into three parts, two of those parts (10,) will be the number of yards for the lining, and the other part (5,) will be the yards for the silk, as before.

NOTE.—The student should perform each question by analysis.

2. A and B laid out equal sums in trade; A gained a sum equal to $\frac{1}{4}$ of his stock, and B lost \$225; then A's money was double that of B. What did each lay out? Ans. \$600.

3. A person being asked the age of each of his sons, replied, that his eldest son was 4 years older than the second, his second, 4 years older than the third, his third son, 4 years older than the fourth, or youngest, and his youngest was half the age of the oldest. What was the age of each of his sons?

Ans. 12, 16, 20, 24 years.

4. A gentleman has two horses, and a saddle worth \$50. Now, if the saddle be put on the first horse, it will make his value double that of the second horse; but, if it be put on the second, it will make his value triple that of the first. What was the value of each horse?

Ans. The first \$30, second \$40.

5. A gentleman was asked the time of day, and replied, that $\frac{3}{4}$ of the time past from noon, was equal to $\frac{8}{9}$ of the time to midnight. Required the time. Ans. 12 minutes past 3.

6. A and B have the same income. A saves $\frac{1}{12}$ of his; but B by spending \$100 per annum more than A, at the end of 10 years, finds himself \$600 in debt. What was their income?

Ans. \$480.00.

7. A gentleman hired a laborer on these conditions; that, for every day he wrought he should receive 60 cents; and for every day he was absent he should forfeit 80 cents. At the expiration of the term he received \$33. How many days did he work, and how many days was he idle?

Ans. He labored 75 days, and was idle 15 days.

The following question, with some variations in the language, is taken from Fenn's Algebra, page 62. It is believed, however, that Sir Isaac Newton was the author of it.

8. If 12 oxen eat $3\frac{1}{2}$ acres of grass in 4 weeks; and 21 oxen eat up 10 acres in 9 weeks; how many oxen would it require to eat up 24 acres in 18 weeks, the grass to be growing uniformly?

Ans. 36 oxen.

OPERATION.

Assume 300 pounds to be growing on each acre (any other number would answer as well); then $3\frac{1}{2}$ acres will contain 1000 pounds. We now suppose the weekly increase to be 9 pounds; then $3\frac{1}{2}$ acres will, in four weeks, produce 120 pounds.

$$3\frac{1}{2} \times 300 = 1000$$

$$9 \times 3\frac{1}{2} \times 4 = 120$$

$$\text{Amount of acres in 4 weeks} = 1120 \text{ lbs.}$$

Having found that 12 oxen will eat up 1120 pounds of grass in 4 weeks, we wish to know how many pounds 21 oxen would eat in 9 weeks, which by the following process we find to be 4410 pounds.

$$\text{Thus, } \left. \begin{array}{l} 12 : 21 \\ 4 : 9 \end{array} \right\} :: 1120 : 4410 \text{ lbs.}$$

But we find the amount of the grass of 10 acres in 9 weeks, to be 3810 pounds.

$$\begin{array}{r} \text{Thus, } 300 \times 10 = 3000 \\ 9 \times 10 \times 9 = 810 \end{array}$$

But by the supposition, 21 oxen in 9 weeks would eat $\begin{array}{r} 3810 \text{ lbs.} \\ = 4410 \text{ lbs.} \end{array}$

The first error will therefore be $\begin{array}{r} \\ = -600 \end{array}$

We next suppose the weekly increase to be 18 pounds per acre; therefore, the amount of the grass of $3\frac{1}{2}$ acres in 4 weeks will be 1240 pounds.

$$\begin{array}{r} \text{Thus, } 300 \times 3\frac{1}{2} = 1000 \\ 18 \times 3\frac{1}{2} \times 4 = 240 \\ \hline 1240 \text{ lbs.} \end{array}$$

And the amount of 10 acres in 9 weeks would be 4620 pounds.

$$\begin{array}{r} \text{Thus, } 10 \times 300 = 3000 \\ 10 \times 18 \times 9 = 1620 \\ \hline 4620 \end{array}$$

But by the last supposition, we find, that 21 oxen in 9 weeks would eat $4882\frac{1}{2}$ pounds.

$$\begin{array}{l} \text{Thus, } 12 : 21 \} \\ \quad \quad 4 : 9 \end{array} :: 1240 : 4882\frac{1}{2} \text{ lbs.}$$

By subtracting 4620 from $4882\frac{1}{2}$ pounds, we find the *second* error to be $\begin{array}{r} 4882\frac{1}{2} \\ 4620 \\ \hline -262\frac{1}{2} \end{array}$

First supposition = 9×600 —first error.
Second supposition = $18 \times 262\frac{1}{2}$ —second error.

$$\begin{array}{r} 600 \quad 10800 \quad 2362\frac{1}{2} \\ 262\frac{1}{2} \quad 2362\frac{1}{2} \\ \hline 337\frac{1}{2} \quad 8437\frac{1}{2} \end{array}$$

(25 lbs. weekly increase.
 $8437\frac{1}{2}$

Having assumed 300 pounds to the acre, and found the weekly increase to be 25 pounds to the acre, which is $8\frac{1}{3}$ per cent., we now proceed to find the amount of the produce of 24 acres for 18 weeks.

$$\begin{array}{r} \text{Thus, } 24 \times 300 = 7200 \\ 25 \times 18 \times 24 = 10800 \end{array}$$

Amount of 24 acres for 18 weeks = 18000 lbs.

$$\begin{array}{r} 3\frac{1}{3} \times 300 = 1000 \\ 3\frac{1}{3} \times 4 \times 25 = 333\frac{1}{3} \end{array}$$

Actual amount of $3\frac{1}{3}$ acres for 4 weeks = 1333 $\frac{1}{3}$ lbs.

The question now is; if 12 oxen eat 1333 $\frac{1}{3}$ pounds of grass in four weeks, how many oxen will eat 18000 pounds in 18 weeks?

$$\begin{array}{l} \text{Then, } 1333\frac{1}{3} \text{ lbs. : 18000 lbs. } \} \\ \quad 18 \text{ weeks : 4 weeks, } \} :: 12 : 36 \text{ oxen. Answer.} \end{array}$$

By analysis.

Each ox eats a certain quantity in each week, which we may suppose to be 100 pounds; and of the whole quantity eat up in each case, a part must have already grown during the time of eating.

Then, by the first conditions of the question,

$$12 \times 4 \times 100 = 4800 \text{ lbs.} = \text{whole quantity on } 3\frac{1}{3} \text{ acres for 4 weeks.}$$

$$4800 \div 3\frac{1}{3} = 1440 \text{ lbs.} = \text{whole quantity on 1 acre for 4 weeks.}$$

By the second conditions of the question,

$$21 \times 9 \times 100 = 18900 \text{ lbs.} = \text{whole quantity on 10 acres for 9 weeks.}$$

$$18900 \div 10 = 1890 \text{ lbs.} = \text{whole quantity on 1 acre for 9 weeks.}$$

$$1890 - 1440 = 450 \text{ lbs.} = \text{the quantity grown on an acre for } 9 - 4 = 5 \text{ weeks.}$$

$$450 \div 5 = 90 \text{ lbs.} = \text{the quantity which grows on each acre for 1 week.}$$

$$90 \times 3\frac{1}{3} \times 4 = 1200 \text{ lbs.} = \text{quantity grown on } 3\frac{1}{3} \text{ acres for 4 weeks.}$$

$$4800 - 1200 = 3600 \text{ lbs.} = \text{original quantity of grass on } 3\frac{1}{3} \text{ acres.}$$

$3600 \div 3\frac{1}{2} = 1080$ lbs. = original quantity on 1 acre.

Then, by the last condition of the question,

$24 \times 1080 = 25920$ lbs. = original quantity on 24 acres.

$24 \times 90 \times 18 = 38880$ lbs. = quantity which grows on 24 acres in 18 weeks.

$25920 + 38880 = 64800$ lbs. = whole quantity on 24 acres for 18 weeks.

$64800 \div 18 = 3600$ lbs. = quantity to be eat from 24 acres each week.

$3600 \div 100 = 36$ = number of oxen required to the whole, and the answer to the question as before.

9. There is a fish, whose head weighs 15 pounds, his tail weighs as much as his head, and $\frac{1}{3}$ as much as his body, and his body weighs as much as his head and tail. Required the weight of the fish. Ans. 72 lbs.

10. A certain grocer has only 5 weights; with these he can weigh any quantity, from 1 pound to 121 pounds. Required the weights.

EXCHANGE.

Exchange is the act of paying or receiving the money of one country for its equivalent in the money of another country, by means of bills of exchange. This operation, therefore, comprehends both the reduction of moneys, and the negotiation of bills. It determines the comparative value of the currencies of all nations; and shows how foreign debts are discharged, loans and subsidies paid, and other remittances made from one country to another, without the risk, trouble, or expense of transporting specie or bullion.

BILLS OF EXCHANGE.

A Bill of Exchange is a written order for the payment of a certain sum of money, at an appointed time. It is a mercantile contract, in which four persons are mostly concerned; viz.

1. The *drawer*, who receives the value, and is also called the *maker* and *seller* of the bill.

2. His debtor, in a distant place, upon whom the bill is drawn, and who is called the *drawee*. He is also called the acceptor, when he accepts the bill, which is an engagement to pay it when due.

3. The person who gives value for the bill, who is called the *buyer*, *taker*, and *remitter*.

4. The person to whom it is ordered to be paid, who is called the *payee*, and who may, by endorsement, pass it to any other person.

Most mercantile payments are made in bills of exchange, which generally pass from hand to hand, until due, like any other circulating medium; and the person who at any time has a bill in his possession, is called the *holder*.

When the holder of a bill disposes of it, he writes his name on the back, which is called *indorsing*; and the payee should be the first indorser. If the bill be indorsed in favor of any particular person, it is called a *special indorsement*; and the person to whom it is thus made payable, is called the *indorsee*, who must also indorse the bill, if he negotiates it. Any person may indorse a bill, and every indorser (as well as the acceptor, or payee,) is a security for the bill, and may therefore be sued for payment.

The *term* of a bill varies according to the agreement between the parties, or the custom of countries. Some bills are drawn at sight; others, at a certain number of days, or months, after sight or after date; and some, at *usance*, which is the customary or usual term between different places.

Days of grace, are a certain number of days granted to the acceptor, after the term of a bill is expired. Three days are usually allowed.

In reckoning when a bill, payable after date, becomes due, the day on which it is dated is not included; and if it be a bill payable after *sight*, the day of presentment is not included. When the term is expressed in months, calendar months are understood; and when a month is longer than the preceding, it is a rule not to go in the computation, into a third month.

Thus, if a bill be dated the 28th, 29th, 30th, or 31st of January, and payable one month after date, the term equally expires on the last day of February, to which the day of grace must, of course, be added; and, therefore, the bill becomes due on the third of March.

Form of a Bill of Exchange.

Boston, September 25, 1835.

Exchange for 5.000.£ Sterling.

At ninety days sight of this, my first Bill of Exchange, (second and third of the same tenor and date unpaid,) pay to James Ayer, or order, five thousand pounds sterling, with or without further advice from me.

John L. French.

Messrs. Dana & Hyde,
Merchants, Liverpool.

ACCEPTING BILLS.

When a bill is presented for acceptance, it is generally left till the next day; and the common way of accepting, is, for the drawee to write his name at the bottom, or across the body of the bill with the word *accepted*.

When two or more persons are in partnership, the acceptance of one binds all the others, if the bill concerns their joint trade; but if it should be made known to the person who receives the bill, that it concerns the acceptor only, in a distinct interest, he alone, as acceptor, can be sued.

A clerk or servant may accept a bill for his master, when he has authority for that purpose; or, if he usually transacts business of this nature for him; and his acceptance binds the master. But if the bill be drawn nominally on the servant, directing him to place it to the account of his master, and if the servant should accept it generally, without specifying that he does it for his master's account, the acceptance binds the servant only, and not his employer.

When a bill is drawn for the account of a third person, and is accepted as such, and he fails without making provision for its payment, the acceptor must discharge the bill, and can have no recourse against the drawer.

A bill may be accepted to be paid at a longer period than is mentioned in the bill, or to pay a part of the sum only; such an acceptance is binding on him who made it; but the holder is at liberty to take it as it is offered, or to act as if acceptance had been entirely refused.

INDORSING BILLS.

Bills, payable to bearer, are transferred by simple delivery, and without any indorsement; but, in order to transfer a bill, payable to order, the holder must express his order of paying to another person, which is always done by an indorsement.

An indorsement may be blank or special. A *blank indorsement* consists only of the indorser's name, and the bill becomes then transferable by simple delivery; a *special indorsement* orders the money to be paid to some particular person, or to his order; a blank indorsement may always be filled up with any person's name, so as to make it special.

An indorsement may take place at any time after the bill is issued, even after the day of payment is elapsed.

A person who receives a bill with a blank indorsement, may take it as indorsee, negotiate it again, or demand payment on his own account, or he may receive the money as agent, or for the account of the indorser; and the latter, notwithstanding his indorsement, may still appear as holder, in an action against the drawer or acceptor.

A special indorsement need not contain the words, *to order*, and the bill is negotiable; it may, also, be restrictive, giving authority to the indorsee to receive the money for the indorser, but not to transfer the bill again to another.

An indorsement for part of the money only, is not valid, except with regard to him who makes it; the drawer and acceptor are not bound by it.

When the holder of a bill dies, his executors may indorse it; but by so doing, they become answerable to their indorsee, personally, and not as executors.

PROTESTING BILLS.

When acceptance or payment has been refused, the holder of the bill should give regular and immediate notice to all the parties, to whom he intends to resort for payment; and if, on account of unnecessary delay, a loss should be incurred by the failure of any of the parties, the holder must bear the loss.

With respect to the manner in which notices of non-accept-

ance, or non-payment are to be given, a difference exists between inland and foreign bills.

For foreign bills a protest is indispensably necessary; thus, a public notary is to appear with the bill, and to demand either acceptance or payment; and, on being refused, he is to draw up an instrument, called a *protest*, expressing that acceptance or payment has been demanded, and refused, and that the holder of the bill intends to recover any damages, which he may sustain in consequence. This instrument is admitted in foreign countries, as legal proof of the fact.

It is customary, as a precaution against accidents or miscarriage, to draw three copies of a foreign bill, and to send them by different posts. They are denominated the *first*, *second*, and *third of exchange*; and when any one of them is paid, the rest become void and of no value. When the acceptor of a bill becomes insolvent, or absconds before the term of payment is expired, the holder may cause a notary to demand better security, and, on that being refused, to protest the bill for want of it. In such cases, however, the most general practice is to wait the regular time, till the bill becomes due.

The damages incurred by non-acceptance and non-payment, besides interest, consist, usually, of the exchange, re-exchange, commission, and postage together, with the expenses of protest, and interest. The exchange is reckoned according to the course at sight, from the place where the protest is made, to the place where the bill is to be paid by the drawer; and, if it be not paid there, the exchange is then reckoned from the same place, to that, where the bill is paid, and also, double commission. The interest commences from the day, when the demand was made.

RECOVERING BILLS.

The drawer, acceptor, and even indorser of a bill, are equally liable to the payment of it; and though the holder can have but one satisfaction, yet, until such satisfaction is actually had, he may sue any of them, or all of them, either at the same time, or in succession, and obtain judgment against them all, till satisfaction be made. Proceedings cannot be staid in any action, but on payment of the debt and costs, not only in that action: but in all the others in which judgment has not been *d*; and though the principal sum should be paid by

one of the parties, still costs may be recovered in the several actions against the others.

When acceptance is refused, and the bill is returned by protest, an action may be commenced immediately against the drawer, though the regular time of payment be not arrived. His debt, in such a case, is considered as contracted the moment the bill is drawn. Thus, if before the bill is returned, the drawer should become a bankrupt, the debt was contracted before the commission of bankruptcy took place.

Nothing will discharge an indorser from his engagement, but the absolute payment of the money; not even a judgment recovered against the drawer, or any previous indorser, or any execution against any of them, unless the money be paid in consequence.

INLAND EXCHANGE, OR DRAFTS.

By inland exchange, is understood, the act of remitting bills to places in the same country; by which means, debts are discharged more conveniently than by cash remittances.

Suppose, for example, A, of Boston, is creditor to B, of Baltimore, \$100, and C, of Boston, debtor to D, of Baltimore, \$100, both these debts may be discharged by means of one bill. Thus, A draws for this sum on B, and sells his bill to C, who remits it to D, and the latter receives the amount, when due from B. Here, by a transfer of claims, the Boston debtor pays the Boston creditor; and the Baltimore debtor the Baltimore creditor; and no money is sent from one place to the other. The same would take place if D, of Baltimore, drew on C, of Boston, and sold his bill to B, of Baltimore, who should send it to A, of Boston; the effect, in either case, being merely a transfer of debtors and creditors.

NOTE.—In this operation, A is the *drawer* and *seller*, B the *drawee* and *acceptor*, C the *buyer* and *remitter*, and D the *payee*, if his name be mentioned in the bill; and he is the *holder* when he receives the bill from A. When D, or any other holder, presents the bill for acceptance or payment, he is called the *presenter*.

By the foregoing example, it appears, that reciprocal and equal debts, due between two places, may be discharged without remitting specie; and it may be supposed, that such an operation is of equal convenience to all parties concerned; but

when the debts are unequal, the advantage must be different, as the obligation of remittance is no longer mutual, because the debtor place must pay its balance, either by sending cash, or bills; and as the latter mode is generally preferred, an increased demand for bills must be the consequence, which enhances their price, as it would that of any other article of sale, or purchase.

PAR OF EXCHANGE.

The Par of exchange, may be considered under two general heads; viz. the *intrinsic par*, and the *commercial par*, each of which, admits of subordinate divisions and distinctions.

The *intrinsic par* is the value of the money of one country, compared with that of another, with respect both to weight and fineness.

The *commercial par* is the comparative value of the moneys of different countries, according to the weight, fineness, and market prices of the metals.

Thus, two sums of different countries are *intrinsically* at par, when they contain an equal quantity of the same kind of pure metal; and two sums of different countries are *commercially* at par, when they can purchase an equal quantity of the same kind of pure metal.

COURSE OF EXCHANGE.

The Course of Exchange, is the variable price of the money of one country, which is given for a fixed sum of money of another country; the latter is called the *certain*, and the former, the *uncertain* price, as before stated.

When the market price of foreign bills is above par, the exchange is said to be favorable to the place that gives the certain for the uncertain.

It should, however, be recollected, that when the exchange is favorable to a place, it is only so to the buyers and remitters of bills, but it is unfavorable to the drawers and sellers.

Thus, the interest of the remitter is identified with that of the place where he purchases the bill, and the interest of the drawer with that of the place where his funds are established, and on which he draws.

It is natural to inquire, why such prices are considered favorable, or unfavorable, if the drawers and remitters, whose interests are opposite, are natives of the same country. The usual answer is, that when the exchange is against a place, it becomes the interest of remitters to pay their foreign debts in specie instead of bills, and the exportation of the precious metals is often considered a national disadvantage.

The fluctuations of exchange are occasioned by various circumstances, both political and commercial. The principal cause is generally stated to be the balance of trade; that is, the difference between the commercial exports and imports of any one country with respect to another. Experience, however, shows, that the exchange may be unfavorable to a country when the balance of trade is greatly in its favor; for the demand for bills must chiefly depend on the balance of such debts as come into immediate liquidation; that is to say, on the *balance of payments*.

Besides, it does not follow, that large exports are always successful, or quick in their returns; and even should it be the case, the balance of payments may still be unfavorable from political causes.

When any alteration takes place in the coin or currency of a country, the exchange will, of course, vary so as to keep pace or correspond to such alteration. This, however, cannot be considered a change in the price of bills, but in the money in which they are bought or sold.

In times of peace, the course of exchange seldom remains long unfavorable to any country, at least, beyond the expense that might be incurred by the transportation of the precious metals; for bullion is considered the universal currency of merchants, and exchange gives it circulation, and thus tends to maintain the level of money throughout the commercial world.

An unfavorable course of exchange may, therefore, be corrected, either by the exportation of bullion, or the shipment of goods—and another method sometimes offers, by negotiating bills through several places; but the latter remedy must fail if the exchange be universally unfavorable.

From what has been said of the causes, both commercial and political, which produce the fluctuations of exchange, and which sometimes counteract or balance each other, the following simple conclusion may be drawn;—that bills rise or fall in their prices, like any other saleable articles, according to the proportion that exists between the demand and supply.

AMSTERDAM.

Accounts are kept in florins, stivers, and pennings, or in pounds, shillings and pence flemish.

16 pennings=1 stiver.

20 stivers=1 florin or guilder.

Also, 12 grotes or pence flemish, or

6 stivers=1 shilling flemish.

20 shillings flemish, or

6 florins=1 pound flemish.

2½ florins, or 50 stivers=1 rix dollar.

1. United States on Amsterdam. Reduce 896 florins, 10 stivers to federal money, exchange at 38 cents per florin.

Ans. \$340.67.

2. Amsterdam on the United States. Reduce \$340.67 to the money of Amsterdam, exchange at 38 cents per florin.

Ans. 896 florins, 10 stivers.

CONSTANTINOPLE.

Accounts are kept in piastres, paras, and aspers; or in piastres and aspers; sometimes in piastres and half paras, or in piastres and minas.

3 aspers=1 para.

40 paras=1 piastre or Turkish dollar.

Also, 80 half paras, or 100 minas=1 piastre.

3. United States on Constantinople. Reduce 78 piastres, 20 paras to federal money, exchange at 40 cents per piastre.

Ans. \$31.30.

4. Constantinople on the United States. Reduce \$31.30 to the money of Constantinople. Ans. 78 piastres, 20 paras.

COPENHAGEN.

Accounts are kept here, in rix dollars, marks, and skillings Danish, but sometimes in rix dollars, marks, and skillings lubs. Pfenings are also occasionally reckoned.

12 pfenings=1 skilling.

16 skillings=1 mark.

marks Danish, or 3 marks lubs=1 ryksdaler, or rix dollar.

5. United States on Copenhagen. Reduce 896 rix dollars, 3 marks to federal money, exchange at 50 cents per rix dollar.
Ans. \$498.25.

DANTZIC.

Accounts are computed here, in florins, groschen, and pfenings.

- 3 pfenings=1 groschen.
30 groschen=1 florin.
3 florins=1 rix dollar.

6. United States on Dantzic. Reduce 196 rix dollars, 2 florins to federal money, exchange at 17 cents per florin.
Ans. \$86.53.

7. Dantzic on the United States. Reduce \$86.53 to the currency of Dantzic.
Ans. 169 rix dollars, 2 florins.

FRANCE.

Computations are made in francs and centimes; or in livres, sous, and deniers.

- 10 centimes=1 decime.
10 decimes=1 franc.
12 deniers=1 sou or sol.
20 sous=1 livre tournois.
80 francs=81 livres.
3 livres=1 ecu of exchange.

8. United States on France. Reduce 8763 francs, 30 centimes to federal money, exchange at \$1 per 5 francs, 35 centimes.
Ans. \$1638.

9. France on the United States. Reduce \$1638 to French money, exchange at 5 francs, 35 centimes to the dollar.
Ans. 8763 francs, 30 centimes.

HAMBURGH.

Computations are made in marks, schillings, and pfenings, banco or current,—banco bears an agio on currency, from 20 to 25 per cent.

12 pfenings=1 schilling or sol lub.

16 schillings lub=1 mark.

3 marks=1 rix dollar.

10. United States on Hamburg. Reduce 675 rix dollars, marks to federal money, exchange at 30 cents per mark.

Ans. \$608.10.

11. Hamburg on the United States. Reduce \$608.10 to the currency of Hamburg, exchange at 30 cents per mark.

Ans. 675 rix dollars, 2 marks.

LEGHORN.

Accounts are kept in pezze, soldi, and denari di pezza.

12 denari di pezza=1 soldo di pezza.

20 soldi di pezza=1 pezza.

12 denari di lira=1 soldo di lira.

20 soldi di lira=1 lira.

12. United States on Leghorn. Reduce 286 pezza, 10 soldi to federal money, exchange at 90 cents per pezza.

Ans. \$257.85.

13. Leghorn on the United States. Change \$257.85 to the currency of Leghorn.

Ans. 286 pezza, 10 soldi.

MILAN.

Accounts are kept in lire soldi, and denari correnti or imperiali.

12 denari=1 soldo.

20 soldi=1 lira.

106 soldi or lire imperiali=150 soldi or lire correnti=1 filippo.

117 soldi imperiali=1 scudo or crown.

14. United States on Milan. Change 176 lira, 10 soldi to federal money, the lira being valued at 20 cents. Ans. \$35.30.

15. Milan on the United States. Reduce \$35.30 to the currency of Milan.

Ans. 176 lira, 10 soldi.

NAPLES.

Computations are made in ducats of 100 grains.

10 grani=1 carlino.

10 carlini=1 ducato di regno.

16. United States on Naples. Change 769 ducati de regno, 5 carlini to federal money, the value of the ducato being 80 cents. Ans. \$615.60.

17. Naples on the United States. Reduce \$615.60 to the currency of Naples. Ans. 769 ducati de regno, 5 carlini.

SICILY.

Accounts are kept here, in oncie, tari and grani; and also, in scudi, tari, and grani.

20 grani=1 tari.

30 tari=1 oncia.

Also, 12 tari=1 scudo or Sicilian crown.

5 scudi=2 oncia.

18. United States on Sicily. Change 876 oncia, 3 scudi to federal money, the oncia being valued at \$2.38.3.

Ans. \$2090.36.7.

19. Sicily on the United States. Change \$2090.36.7 to the currency of Sicily. Ans. 876 oncia, 3 scudi.

RUSSIA.

Computations are made here, in rubles and copecks.

10 copecks=1 griev or grievener.

10 grieves=1 ruble.

20. United States on Russia. What is the value of 7684 rubles, 8 grieves in federal money, the value of the ruble in the United States being 75 cents? Ans. \$5763.60.

21. Russia on the United States. What is the value of \$5763.60 in Russian currency? Ans. 7684 rubles, 8 grieves.

ROME.

Accounts are kept in ecudi moneta, and bajocchi; or in scudi di stampa soldi, and denari d'oro quattrini, and mezzi quattrini are sometimes reckoned.

2 mezzi quattrini=1 quattrino.

5 quattrini=1 bajocchio.

10 bajocchi=1 paolo.

10 paoli=1 scudo moneta, or Roman crown.

22. United States on Rome. Change 7689 scudi moneta to federal money, the value of the scudi being \$1.00.0⁸⁷/₁₀₀.

Ans. \$7694.15¹⁸³/₁₀₀₀.

23. Rome on the United States. Change \$7694.15¹⁸³/₁₀₀₀ to Roman currency.

Ans. 7689 scudo moneta.

SPAIN.

The general mode of keeping accounts in Spain, is in maravedis and reals.

34 maravedis=1 real.

8 reals=1 dollar of plate.

• 375 maravedis=1 ducat of exchange.

4 dollars of plate=1 pistole of exchange.

Exchanges are generally computed in denominations of plate, which is always understood to be *old plate*, if *new plate* be not mentioned.

There are three principal denominations of these imaginary moneys in which exchanges are generally transacted; viz., dollars, doubloons and ducats, and they are divided into reals and maravedis of plate, and sometimes converted into vellon and other denominations.

The dollar of exchange, also called *peso*, or *piastre de cambio*, or *de plata*, is divided into 8 reals of 34 maravedis of plate each, and sometimes into 16 quartos.

The *doubloon de plata*, or pistole of exchange, is four times the dollar, and therefore contains 32 reals, or 1088 maravedis of plate.

The ducat of plate, also called *ducado de cambio*, contains 11 reals 1 maravedi, or 375 maravedis of plate.

At Alicant, Valencia, and Barcelona, exchanges are transacted in libras of 20 sueldos, or 240 dineros.

The libra of Alicant and Valencia is the dollar of plate. This is sometimes divided into 10 reals of new plate, which are, of course, equal to 8 reals of old plate.

The libra of Barcelona, commonly called *libra catalan*, is worth 5½ reals of plate; hence 7 of those libras equal 5 dollars of plate, and therefore, 28 sueldos catalan equal 1 dollar.

The hard dollar of 20 reals vellon, is occasionally used in exchanges, and is also divided into 12 reals, each of 16 quartos. The current dollar, which is an imaginary money, valued at

two-thirds of the hard dollar, is divided into 8 reals, and the real into 16 quartos. The two latter are the principal moneys of exchange used at Gibraltar.

24. United States on Spain. What is the value in federal money of 76 dollars of plate, exchange at 75 cents for a plate dollar?
Ans. \$5700.

25. Spain on the United States. What is the value of \$5700 in Spanish money, exchange at 75 cents per dollar of plate.
Ans. 7600 dollars of plate.

SWEDEN.

Accounts are kept in rix dollars, skillings and fenings.

12 fenings=1 skilling.

48 skillings=1 rix dollar.

26. United States on Sweden. Reduce 476 rix dollars, 24 skillings to federal money, the rix dollar being valued at 107 cents.
Ans. \$509.85.5.

27. Sweden on the United States. Change \$509.85.5 to the currency of Sweden.
Ans. 476 rix dollars, 24 skillings.

TURIN.

Accounts are kept in lire, soldi and denari.

12 denari=1 soldi.

20 soldi=1 lira.

28. United States on Turin. Change 462 lira, 10 soldi to federal money, exchange at 20 cents per lira.
Ans. \$92.50.

29. Turin on the United States. Change \$92.50 to the currency of Turin, exchange at 20 cents per lira.
Ans. 452 lira, 10 soldi.

VIENNA.

Computations are made in florins and creutzers, or in rix dollars and creutzers.

4 pfenings=1 creutzer.

60 creutzers=1 florin.

1½ florins=1 rix dollar of account.

2 florins=1 " " specie.

30. United States on Vienna. Reduce 876 rix dollars, specie, 1 florin to federal money, the specie rix dollar being equal to 97 cents. Ans. \$850.20.

31. Vienna on the United States. Change \$850.20 to the currency of Vienna. Ans. 876 rix dollars, specie, 1 florin.

EAST INDIES.

BENGAL, CALCUTTA, ETC.

12 pice=1 anna.

16 annas=1 rupee.

1 sica rupee=2s. 6d. sterling.

32. United States on Calcutta. Reduce 432 rupees, 12 annas to federal money, exchange at 50 cents per rupee.

Ans. \$216.37½.

33. Calcutta on the United States. Reduce \$216.37½ to the currency of Calcutta, exchange at 50 cents per rupee.

Ans. 432 rupees, 12 annas.

BOMBAY.

100 rees=1 quarter.

4 quarters=1 rupee.

1 rupee=2s. 4d. sterling.

34. United States on Bombay. Change 678 rupees, 2 quarters to federal money, the rupee being 50 cents.

Ans. \$339.25.

35. Bombay on the United States. Change \$339.25 to Bombay money, reckoning the rupee at 50 cents.

Ans. 678 rupees, 2 quarters.

MADRAS.

Accounts are kept here, in pagodas, fanams, and cash.

80 cash=1 fanam.

45 fanams=1 star pagoda.

1 star pagoda=8s. sterling.

36. United States on Madras. Change 375 stars pagoda to federal money, the star pagoda valued at \$1.777.

Ans. \$666.66+.

37. Madras on the United States. Reduce \$896 to the currency of Madras.
Ans. 504 pagodas.

Ans. 504 pagodas.

TRIESTE.

Accounts are here kept, in pfenings, florins, and creutzers.

4 pfenings=1 creutzer.

60 creutzers=1 florin.

1½ florins=1 rix dollar.

38. United States on Trieste. What is the value in federal money of 769 rix dollars, 40 creutzers, the value of the rix dollar being 92 cents. Ans. \$707.88.

Ans. \$707.88¢.

39. Trieste on the United States. Reduce \$707.88½ to the currency of Trieste. Ans. 769 rix dollars, 40 creutzers.

Ans. 769 rix dollars, 40 creutzers.

GREAT BRITAIN.

Accounts are here kept, in pounds, shillings, pence, and farthings, sterling. The principal coins are guineas and crowns, and their fractional parts.

The guinea sterling is 21 shillings.

Crown. 5 "

United States on England.

40. A merchant in Boston has a bill on London for 1728*£* 15*s.* 6*d.*; what is the value of this, the exchange being 5 per cent. above par? Ans. \$8067.62.

Ans. \$8067.62.

England on the United States.

41. What should a merchant in London give for a bill on Boston, for \$8967.75, the exchange being 2 per cent. below par?

Ans. 197£ 14s. 9½d.

1728 | 8067.62 ¹⁶⁵ ~~480~~ (4)
~~6640~~
2155
6912
1000

VALUE OF GOLD COINS,

ACCORDING TO THE LAWS OF MAY AND JUNE, 1834.

| NAMES OF COINS. | Weight. | Former | Standard |
|--|--------------------|----------|----------|
| | dwt. gr. | \$ c. m. | \$ c. m. |
| UNITED STATES. | | | |
| Eagle coined before July 31, 1834, | 11 6 | 10 | 10 66 5 |
| Shares in proportion . . . | | | |
| <i>Foreign gold.</i> | | | |
| AUSTRIAN DOMINIONS. | | | |
| Souverein, | 3 14 | 3 17 6 | 3 37 7 |
| Double ducat, | 4 12 | 4 29 9 | 4 58 9 |
| Hungarian, ducat, | 2 5 $\frac{1}{2}$ | 2 15 4 | 2 29 6 |
| BAVARIA. | | | |
| Carolín, | 6 5 $\frac{1}{2}$ | 4 64 6 | 4 95 7 |
| Max d'or or maximilian, . . . | 4 4 | 3 11 1 | 3 31 8 |
| Ducat, | 2 5 $\frac{1}{2}$ | 2 13 3 | 2 27 5 |
| BERNE. | | | |
| Ducat, double in proportion, . | 1 23 | 1 85 4 | 1 98 6 |
| Pistole, | 4 21 | 4 26 2 | 5 54 2 |
| BRAZIL. | | | |
| Jahannes, $\frac{1}{2}$ in proportion, . | 18 | 16 | 17 06 4 |
| Dobraon, | 34 12 | 30 66 6 | 32 70 6 |
| Dobra, | 18 6 | 16 22 2 | 17 30 1 |
| Moidore, $\frac{1}{2}$ in proportion, . | 6 22 | 6 14 9 | 6 55 7 |
| Crusade, | 16 $\frac{1}{2}$ | 59 8 | 63 5 |
| BRUNSWICK. | | | |
| Pistole, double in proportion, . | 4 21 $\frac{1}{2}$ | 4 27 1 | 4 54 8 |
| Ducat, | 2 5 $\frac{1}{2}$ | 2 09 2 | 2 23 |
| COLOGNE. | | | |
| Ducat, | 2 5 $\frac{1}{2}$ | 2 12 5 | 2 26 7 |
| COLUMBIA. | | | |
| Doubloons, | 17 9 | 14 56 | 15 53 5 |
| DENMARK. | | | |
| Ducat, current, | 2 | 1 70 5 | 1 81 2 |
| at specie, | 2 5 $\frac{1}{2}$ | 2 12 5 | 2 26 7 |
| lian d'or, | 4 7 | 3 77 | 4 02 1 |

EAST INDIA.

| | | | |
|----------------------------|-------------------|--------|--------|
| Rupee, Bombay, 1818, . . . | 7 11 | 6 65 4 | 7 09 6 |
| Rupee, Madras, 1818, . . . | 7 12 | 6 66 7 | 7 11 |
| Pagoda, star, | 2 4 $\frac{3}{4}$ | 1 63 9 | 1 79 8 |

ENGLAND.

| | | | |
|--|-------------------|--------|--------|
| Guinea, $\frac{1}{2}$ in proportion, . . | 5 8 $\frac{1}{2}$ | 4 79 9 | 5 07 5 |
| Sovereign, " | 5 2 $\frac{1}{2}$ | 4 57 | 4 84 6 |
| Seven shilling piece, . . . | 1 19 | 1 60 | 1 69 8 |

FRANCE.

| | | | |
|-----------------------------------|-------------------|--------|--------|
| Double Louis, coin'd before 1786, | 10 11 | 9 08 7 | 9 69 7 |
| Louis, " " " " | 5 5 $\frac{1}{2}$ | 4 54 1 | 4 84 6 |
| Double Louis, coined since 1786, | 9 20 | 8 59 | 9 15 3 |
| Louis, " " " " | 4 22 | 4 29 5 | 4 57 6 |
| Double Napoleon, or 40 francs, | 8 7 | 7 23 2 | 7 70 2 |
| Napoleon, or 20 " " | 4 3 $\frac{1}{2}$ | 3 61 6 | 3 85 1 |
| Same as the new Louis guinea, | 5 | 4 36 2 | 4 65 5 |

FRANKFORT ON THE MAINE.

| | | | |
|------------------|-------------------|--------|--------|
| Ducat, | 2 5 $\frac{3}{4}$ | 2 13 7 | 2 27 9 |
|------------------|-------------------|--------|--------|

GENEVA.

| | | | |
|------------------------|--------------------|--------|--------|
| Pistole old, | 4 7 $\frac{1}{2}$ | 3 73 7 | 3 98 5 |
| Pistole new, | 3 15 $\frac{1}{4}$ | 3 23 2 | 3 44 4 |

HAMBURGH.

| | | | |
|--------------------------------|-------------------|--------|--------|
| Ducat, double in proportion, . | 2 5 $\frac{3}{4}$ | 2 13 7 | 2 27 9 |
|--------------------------------|-------------------|--------|--------|

GENOA.

| | | | |
|-------------------|-------------------|--------|--------|
| Sequin, | 2 5 $\frac{3}{4}$ | 2 15 8 | 2 30 2 |
|-------------------|-------------------|--------|--------|

HANOVER.

| | | | |
|------------------------------------|-------------------|--------|--------|
| Double Geo. d'or, single in pro'n, | 8 13 | 7 48 2 | 7 87 9 |
| Ducat, | 2 5 $\frac{3}{4}$ | 2 15 4 | 2 29 6 |
| Gold florin, double in proportion, | 2 2 | 1 57 6 | 1 67 |

HOLLAND.

| | | | |
|------------------------------------|-------------------|---------|---------|
| Double ryder, | 12 21 | 11 44 2 | 12 20 5 |
| Ryder, | 6 9 | 5 66 5 | 6 04 3 |
| Ducat, | 2 5 $\frac{3}{4}$ | 2 13 3 | 2 27 5 |
| Ten guilder piece, 5 duc'. in pro. | 4 8 | 3 78 | 4 03 4 |

MALTA.

| | | | |
|-------------------------|-------|--------|--------|
| Double Louis, | 10 16 | 8 69 9 | 9 27 8 |
| Louis, | 5 8 | 4 36 4 | 4 85 2 |
| Demi Louis, | 2 16 | 2 20 2 | 2 33 6 |

MEXICO.

| | | | |
|----------------------------------|------|-------|---------|
| Doubloons, shares in proportion, | 17 9 | 14 56 | 15 53 5 |
|----------------------------------|------|-------|---------|

MILAN.

| | | | |
|-------------------------------|-------------------|--------|--------|
| Sequin, | 2 5 $\frac{3}{4}$ | 2 15 6 | 2 29 |
| Doppia, or pistole, | 4 1 $\frac{1}{2}$ | 3 57 2 | 3 80 7 |

| | | | |
|--|--------------------|---------|---------|
| Forty livre pieces, 1808, . . . | 8 8 | 7 26 1 | 7 74 2 |
| NAPLES. | | | |
| Six Ducat piece, 1783, . . . | 5 16 | 4 92 5 | 5 24 9 |
| Two " " or sequin, 1762, . . . | 1 20 $\frac{1}{2}$ | 1 51 1 | 1 59 1 |
| Three " " or oncetia, 1818, . . . | 2 10 $\frac{1}{4}$ | 2 34 7 | 2 49 |
| NETHERLANDS. | | | |
| Gold lion, or 14 Florence piece, . . . | 5 7 $\frac{3}{4}$ | 4 73 1 | 5 04 6 |
| Ten florence piece, 1820, . . . | 4 7 $\frac{3}{4}$ | 3 76 6 | 4 01 9 |
| PARMA. | | | |
| Quadruple pistole, double in pro. . . | 18 9 | 15 59 6 | 16 62 8 |
| Pistole or dappia, 1787, . . . | 4 14 | 3 93 5 | 4 19 4 |
| " " 1796, . . . | 4 14 | 3 87 5 | 4 13 5 |
| Maria Theresa, 1818, . . . | 4 3 $\frac{1}{2}$ | 3 62 4 | 3 86 1 |
| PIEDMONT. | | | |
| Pistole, coined since 1785, . . . | | | |
| Half pistole in proportion, . . . | 5 20 | 5 07 5 | 5 41 1 |
| Sequin, $\frac{1}{2}$ in proportion, . . . | 2 5 | 2 13 7 | 2 28 |
| Carlino, coin'd since 1785, $\frac{1}{2}$ pro. . . | 29 6 | 25 63 2 | 27 34 |
| Piece of 20 francs, called marengo, . . . | 4 3 $\frac{1}{2}$ | 3 34 1 | 3 56 4 |
| POLAND. | | | |
| Ducat, | 2 5 $\frac{3}{4}$ | 2 13 7 | 2 27 5 |
| PORTUGAL. | | | |
| Dabraon, | 34 12 | 30 66 6 | 32 70 6 |
| Dabra, | 18 6 | 16 22 2 | 17 30 1 |
| Johannes, | 18 | 16 | 17 06 4 |
| Moidoré, $\frac{1}{2}$ in proportion, . . . | 6 22 | 6 14 9 | 6 55 7 |
| Piece of 16 testoons or 1600 rees, . . . | 2 6 | 1 99 2 | 2 12 1 |
| Old crusado of 1400 rees, . . . | 15 | 84 9 | 58 5 |
| New " 480 " . . . | 16 $\frac{1}{2}$ | 59 8 | 63 5 |
| Milree, coined in 1775, . . . | 19 $\frac{3}{4}$ | 73 2 | 78 |
| RUSSIA. | | | |
| Ducat, 1748, | 2 5 $\frac{3}{4}$ | 2 13 7 | 2 27 9 |
| " 1787, | 2 5 $\frac{3}{4}$ | 2 12 5 | 2 26 7 |
| Frederick, double, 1769, . . . | 8 14 | 7 47 5 | 7 95 5 |
| " " 1800, . . . | 8 14 | 7 45 4 | 77 95 1 |
| " single, 1778, . . . | 4 7 | 3 74 9 | 3 99 7 |
| " " 1800, . . . | 4 7 | 3 72 5 | 3 97 5 |
| ROME. | | | |
| Sequin, coined since 1760, . . . | 2 4 $\frac{1}{2}$ | 2 10 9 | 2 25 1 |
| Scudo of republic, | 17 0 $\frac{1}{4}$ | 14 82 8 | 15 81 1 |
| RUSSIA. | | | |
| at, 1796, | 2 6 | 2 15 | 2 29 7 |
| 1763, | 2 5 $\frac{3}{4}$ | 2 12 5 | 2 26 7 |
| uble, 1756, | 1 0 $\frac{1}{2}$ | 90 9 | 96 7 |

| | | | |
|--|--------------------|--------|---------|
| Gold ruble, 1799, | 18 $\frac{1}{2}$ | 69 1 | 73 7 |
| " palten, 1777, | 9 | 33 1 | 35 5 |
| Imperial, 1801, | 7 17 $\frac{1}{2}$ | 7 34 9 | 7 82 9 |
| Half, " | 4 3 $\frac{1}{2}$ | 3 68 9 | 3 93 3 |
| SARDINIA. | | | |
| Carlino, $\frac{1}{2}$ in proportion, . . | 10 7 $\frac{1}{2}$ | 8 88 1 | 9 47 2 |
| SAXONY. | | | |
| Ducat, 1784, | 2 5 $\frac{1}{2}$ | 2 12 5 | 2 26 7 |
| " 1797, | 2 5 $\frac{1}{2}$ | 2 13 7 | 2 27 9 |
| Augustus, 1754, | 4 6 $\frac{1}{2}$ | 3 68 5 | 3 92 5 |
| " 1784, | 4 6 $\frac{1}{2}$ | 3 72 5 | 3 97 4 |
| SICILY. | | | |
| Ounce, 1751, | 2 20 $\frac{1}{2}$ | 2 35 1 | 2 50 4 |
| Double ounce, 1758, | 5 17 | 4 72 7 | 5 04 4 |
| SPAIN. | | | |
| Doubloons, 1772, parts in pro. | 17 8 $\frac{1}{2}$ | 15 03 | 16 02 8 |
| Doubloon, | 17 9 | 14 56 | 15 53 5 |
| Pistole, | 4 8 $\frac{1}{4}$ | 3 64 | 3 88 4 |
| Coronilla, gold dol or vintaren 1801 | 1 3 | 92 1 | 98 3 |
| SWEDEN. | | | |
| Ducat, | 2 5 | 2 09 7 | 2 23 5 |
| SWITZERLAND. | | | |
| Pistole of the Helvetic Republic, 1800, | 4 21 $\frac{1}{2}$ | 4 27 9 | 4 56 |
| TREVES. | | | |
| Ducat, | 2 5 $\frac{1}{2}$ | 2 02 5 | 2 26 7 |
| TURKEY. | | | |
| Sequin, fondueci of Constantinople, | | | |
| " 1773, | 2 5 $\frac{1}{2}$ | 1 74 9 | 1 86 8 |
| " 1789, | 2 5 $\frac{1}{2}$ | 1 73 3 | 1 84 8 |
| Half misseir, 1818, | 18 $\frac{1}{4}$ | 49 1 | 52 1 |
| Sequin fondueci, | 2 5 | 1 71 7 | 1 83 |
| Yeermeeblekblek, | 3 1 $\frac{1}{2}$ | 2 84 | 3 02 8 |
| TUSCANY. | | | |
| Zechino or sequin, | 2 5 $\frac{1}{2}$ | 2 16 6 | 2 31 8 |
| Ruspone of the king. of Etruria, | 6 17 $\frac{1}{2}$ | 6 50 5 | 6 93 8 |
| VENICE. | | | |
| Zechino or sequin, shares in pro. | 2 6 | 2 16 | 2 31 |
| WIRTEMBERG. | | | |
| Carolín, | 6 3 $\frac{1}{2}$ | 4 59 4 | 4 89 8 |
| Ducat, | 2 5 | 2 09 7 | 2 23 5 |
| ZURICH. | | | |
| Ducat, double, and $\frac{1}{2}$ in proportion, | 2 5 $\frac{1}{2}$ | 2 12 5 | 2 28 7 |

GEOMETRY.

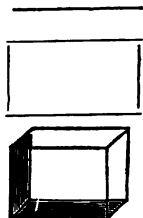
DEFINITIONS.

1. A point is that which has position, but no magnitude, nor dimensions; neither length, breadth, nor thickness. ●

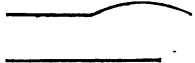
2. A line is length without breadth, or thickness.

3. A surface, or superficies is an extension, or a figure of two dimensions, length and breadth; but without thickness.

4. A body or solid is a figure of three dimensions; viz. length, breadth, and thickness.



5. Lines are either right or curved, or mixed of these two.

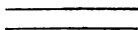


6. A right or straight line lies all in the same direction between its extremities, and is the shortest distance between two points. When a line is mentioned simply, it means a right line.

7. A curve continually changes its direction between its extreme points.

8. Lines are either parallel, oblique, perpendicular, or tangential.

9. Parallel lines are always at the same perpendicular distance, and never meet, though ever so far produced.



10. Oblique lines change their distance, and would meet if produced on the side of the least distance.



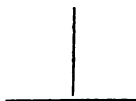
11. One line is perpendicular to another, when it inclines not more on the one side than the other, or when the angles on both sides of it are equal.

12. An angle is the inclination, or opening of two lines having different directions, and meeting in a point.



13. Angles are right or oblique, acute or obtuse.

14. A right angle is that which is made by one line perpendicular to another; or, when the angles on each side are equal to one another, they are right angles.



15. An oblique angle is one, which is made by two oblique lines, and is either less or greater than a right angle.



16. An acute angle is less than a right angle.

17. An obtuse angle is greater than a right angle.

18. Superficies are either plane or curved.

19. A plane superficies, or plane, is that with which a right line may every way coincide; or, if the line touch the plane in two points, it will touch it in every point; but if not, it is curved.

20. Plane figures are bounded either by right lines or curves.

21. Plane figures, that are bounded by right lines, have names according to the number of their sides, or of their angles; for they have as many sides as angles, the least number being three.

22. A figure of three sides and angles, is called a triangle; and it receives particular denominations from the relations of its sides and angles.

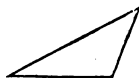
23. An equilateral triangle is that, whose three sides are equal.



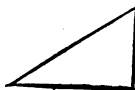
24. An isosceles triangle is that, which has two sides equal.



25. A scalene triangle is that, whose three sides are unequal.



26. A right-angled triangle is that, which has one right angle.



27. Other triangles are oblique-angled, and are either acute or obtuse.

28. An obtuse-angled triangle has one obtuse angle.



29. An acute-angled triangle has its three angles acute.

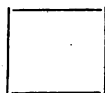
30. A figure of four sides and angles is called a quadrangle, or a quadrilateral.

31. A parallelogram is a quadrilateral, which has both its pairs of opposite sides parallel; and it takes the following particular names; viz. rectangle, square, rhombus, and rhomboid.

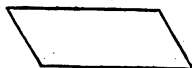
32. A rectangle is a parallelogram, having a right angle.



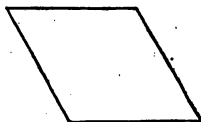
33. A square is an equilateral rectangle, having its length and breadth equal.



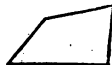
34. A rhomboid is an oblique-angled parallelogram.



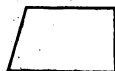
35. A rhombus is an equilateral rhomboid, having all its sides equal, but its angles oblique.



36. A trapezium is a quadrilateral, which has not its opposite sides parallel.



37. A trapezoid has only one pair of its opposite sides parallel.



38. A diagonal is a line joining any two opposite angles of a quadrilateral.



39. Plane figures, that have more than four sides, are in general called polygons; and they receive other particular names, according to the number of their sides or angles. Thus,

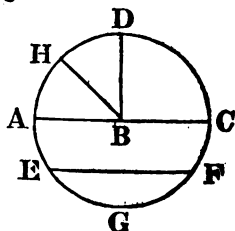
40. A pentagon is a polygon of five sides; a hexagon, of six sides; a heptagon, of seven; an octagon, of eight; a nonagon, of nine; a decagon, of ten; an undecagon, of eleven; and a dodecagon, of twelve sides.

41. A regular polygon has all its sides and all its angles equal. If they are not both equal, the polygon is irregular.

42. An equilateral-triangle is also a regular figure of three sides, and the square is one of four; the former being also called a trigon, and the latter a tetragon.

43. Any figure is equilateral, when all its sides are equal; and it is equiangular, when all its angles are equal. When both these are equal, it is a regular figure.

44. A circle is a plane figure, bounded by a curve line, called the circumference, which is every where equi-distant from a certain point, called its centre. The circumference itself is often called a circle, and also the periphery.



45. The radius of a circle is a line drawn from the centre to the circumference, as A, B.

46. The diameter of a circle is a line drawn through the centre and terminating at the circumference on both sides, as A, C.

47. An arc of a circle is any part of the circumference, as A, D.

48. A chord is a right line joining the extremities of an arch, as E, F.

49. A segment is any part of a circle bounded by an arc, and its chord, as E, F, G.

50. A semicircle is half the circle, or segment cut off by a diameter. The half circumference is sometimes called the semicircle, as A, G, C.

51. A sector is any part of the circle bounded by an arc and two radii drawn to its extremities, as A, B, H.

52. A quadrant, or quarter of a circle is a sector, having a quarter of its circumference for its arc, and its two radii are

30. United States on Vienna. Reduce 876 rix dollars, specie, 1 florin to federal money, the specie rix dollar being equal to 97 cents. Ans. \$850.20.

31. Vienna on the United States. Change \$850.20 to the currency of Vienna. Ans. 876 rix dollars, specie, 1 florin.

EAST INDIES.

BENGAL, CALCUTTA, ETC.

12 pice=1 anna.

16 annas=1 rupee.

1 sica rupee=2s. 6d. sterling.

32. United States on Calcutta. Reduce 432 rupees, 12 annas to federal money, exchange at 50 cents per rupee.

Ans. \$216.37½.

33. Calcutta on the United States. Reduce \$216.37½ to the currency of Calcutta, exchange at 50 cents per rupee.

Ans. 432 rupees, 12 annas.

BOMBAY.

100 rees=1 quarter.

4 quarters=1 rupee.

1 rupee=2s. 4d. sterling.

34. United States on Bombay. Change 678 rupees, 2 quarters to federal money, the rupee being 50 cents.

Ans. \$339.25.

35. Bombay on the United States. Change \$339.25 to Bombay money, reckoning the rupee at 50 cents.

Ans. 678 rupees, 2 quarters.

MADRAS.

Accounts are kept here, in pagodas, fanams, and cash.

80 cash=1 fanam.

45 fanams=1 star pagoda.

1 star pagoda=8s. sterling.

36. United States on Madras. Change 375 stars pagoda to federal money, the star pagoda valued at \$1.777.

Ans. \$666.66+.

37. Madras on the United States. Reduce \$896 to the currency of Madras.
Ans. 504 pagodas.

Ans. 504 pagodas.

TRIESTE.

Accounts are here kept, in pfenings, florins, and creutzers.

4 pfenings=1 creutzer.

60 creutzers=1 florin.

1½ florins=1 rix dollar.

38. United States on Trieste. What is the value in federal money of 769 rix dollars, 40 creutzers, the value of the rix dollar being 92 cents. Ans. \$707.88g.

Ans. \$707.88¢.

39. Trieste on the United States. Reduce \$707.88 $\frac{1}{2}$ to the currency of Trieste. Ans. 769 rix dollars, 40 creutzers.

Ans. 769 rix dollars, 40 creutzers.

GREAT BRITAIN.

Accounts are here kept, in pounds, shillings, pence, and farthings, sterling. The principal coins are guineas and crowns, and their fractional parts.

The guinea sterling is 21 shillings.

Crown. 5 "

United States on England.

40. A merchant in Boston has a bill on London for 1728*½* 15s. 6d.; what is the value of this, the exchange being 5 per cent. above par? Ans. \$8067.62.

Ans. \$8067.62.

England on the United States.

41. What should a merchant in London give for a bill on Boston, for \$8967.75, the exchange being 2 per cent. below par?

Ans. 197£ 14s. 9½d.

1728 | 8067.62 ¹⁶⁵ ~~480~~ (4)
~~648~~ 420
2155
6912 104

when the debts are unequal, the advantage must be different, as the obligation of remittance is no longer mutual, because the debtor place must pay its balance, either by sending cash, or bills; and as the latter mode is generally preferred, an increased demand for bills must be the consequence, which enhances their price, as it would that of any other article of sale, or purchase.

PAR OF EXCHANGE.

The Par of exchange, may be considered under two general heads; viz. the *intrinsic par*, and the *commercial par*, each of which, admits of subordinate divisions and distinctions.

The *intrinsic par* is the value of the money of one country, compared with that of another, with respect both to weight and fineness.

The *commercial par* is the comparative value of the moneys of different countries, according to the weight, fineness, and market prices of the metals.

Thus, two sums of different countries are *intrinsically* at par, when they contain an equal quantity of the same kind of pure metal; and two sums of different countries are *commercially* at par, when they can purchase an equal quantity of the same kind of pure metal.

COURSE OF EXCHANGE.

The Course of Exchange, is the variable price of the money of one country, which is given for a fixed sum of money of another country; the latter is called the *certain*, and the former, the *uncertain* price, as before stated.

When the market price of foreign bills is above par, the exchange is said to be favorable to the place that gives the certain for the uncertain.

It should, however, be recollected, that when the exchange is favorable to a place, it is only so to the buyers and remitters of bills, but it is unfavorable to the drawers and sellers.

Thus, the interest of the remitter is identified with that of the place where he purchases the bill, and the interest of the drawer with that of the place where his funds are established, and on which he draws.

It is natural to inquire, why such prices are considered favorable, or unfavorable, if the drawers and remitters, whose interests are opposite, are natives of the same country. The usual answer is, that when the exchange is against a place, it becomes the interest of remitters to pay their foreign debts in specie instead of bills, and the exportation of the precious metals is often considered a national disadvantage.

The fluctuations of exchange are occasioned by various circumstances, both political and commercial. The principal cause is generally stated to be the balance of trade; that is, the difference between the commercial exports and imports of any one country with respect to another. Experience, however, shows, that the exchange may be unfavorable to a country when the balance of trade is greatly in its favor; for the demand for bills must chiefly depend on the balance of such debts as come into immediate liquidation; that is to say, on the *balance of payments*.

Besides, it does not follow, that large exports are always successful, or quick in their returns; and even should it be the case, the balance of payments may still be unfavorable from political causes.

When any alteration takes place in the coin or currency of a country, the exchange will, of course, vary so as to keep pace or correspond to such alteration. This, however, cannot be considered a change in the price of bills, but in the money in which they are bought or sold.

In times of peace, the course of exchange seldom remains long unfavorable to any country, at least, beyond the expense that might be incurred by the transportation of the precious metals; for bullion is considered the universal currency of merchants, and exchange gives it circulation, and thus tends to maintain the level of money throughout the commercial world.

An unfavorable course of exchange may, therefore, be corrected, either by the exportation of bullion, or the shipment of goods—and another method sometimes offers, by negotiating bills through several places; but the latter remedy must fail if the exchange be universally unfavorable.

From what has been said of the causes, both commercial and political, which produce the fluctuations of exchange, and which sometimes counteract or balance each other, the following simple conclusion may be drawn;—that bills rise or fall in their prices, like any other saleable articles, according to the proportion that exists between the demand and supply.

AMSTERDAM.

Accounts are kept in florins, stivers, and pennings, or in pounds, shillings and pence flemish.

16 pennings=1 stiver.

20 stivers=1 florin or guilder.

Also, 12 grotes or pence flemish, or

6 stivers=1 shilling flemish.

20 shillings flemish, or

6 florins=1 pound flemish.

2½ florins, or 50 stivers=1 rix dollar.

1. United States on Amsterdam. Reduce 896 florins, 10 stivers to federal money, exchange at 38 cents per florin.

Ans. \$340.67.

2. Amsterdam on the United States. Reduce \$340.67 to the money of Amsterdam, exchange at 38 cents per florin.

Ans. 896 florins, 10 stivers.

CONSTANTINOPLE.

Accounts are kept in piastres, paras, and aspers; or in piastres and aspers; sometimes in piastres and half paras, or in piastres and minas.

3 aspers=1 para.

40 paras=1 piastre or Turkish dollar.

Also, 80 half paras, or 100 minas=1 piastre.

3. United States on Constantinople. Reduce 78 piastres, 20 paras to federal money, exchange at 40 cents per piastre.

Ans. \$31.30.

4. Constantinople on the United States. Reduce \$31.30 to the money of Constantinople. Ans. 78 piastres, 20 paras.

COPENHAGEN.

Accounts are kept here, in rix dollars, marks, and skillings Danish, but sometimes in rix dollars, marks, and skillings lubs. Pfenings are also occasionally reckoned.

12 pfenings=1 skilling.

16 skillings=1 mark.

6 marks Danish, or 3 marks lubs=1 ryksdaler, or rix dollar.

5. United States on Copenhagen. Reduce 896 rix dollars, 3 marks to federal money, exchange at 50 cents per rix dollar.
Ans. \$498.25.

DANTZIC.

Accounts are computed here, in florins, groschen, and pfenings.

- 3 pfenings=1 groschen.
30 groschen=1 florin.
3 florins=1 rix dollar.

6. United States on Dantzic. Reduce 196 rix dollars, 2 florins to federal money, exchange at 17 cents per florin.
Ans. \$86.53.

7. Dantzic on the United States. Reduce \$86.53 to the currency of Dantzic. Ans. 169 rix dollars, 2 florins.

FRANCE.

Computations are made in francs and centimes; or in livres, sous, and deniers.

- 10 centimes=1 decime.
10 decimes=1 franc.
12 deniers=1 sou or sol.
20 sous=1 livre tournois.
80 francs=81 livres.
3 livres=1 ecu of exchange.

8. United States on France. Reduce 8763 francs, 30 centimes to federal money, exchange at \$1 per 5 francs, 35 centimes.
Ans. \$1638.

9. France on the United States. Reduce \$1638 to French money, exchange at 5 francs, 35 centimes to the dollar.
Ans. 8763 francs, 30 centimes.

HAMBURGH.

Computations are made in marks, schillings, and pfenings, banco or current,—banco bears an agio on currency, from 20 to 25 per cent.

12 pfenings=1 schilling or sol lubs.

16 schillings lubs=1 mark.

3 marks=1 rix dollar.

10. United States on Hamburg. Reduce 675 rix dollars, marks to federal money, exchange at 30 cents per mark.

Ans. \$608.10.

11. Hamburg on the United States. Reduce \$608.10 to the currency of Hamburg, exchange at 30 cents per mark.

Ans. 675 rix dollars, 2 marks.

LEGHORN.

Accounts are kept in pezze, soldi, and denari di pezza.

12 denari di pezza=1 soldo di pezza.

20 soldi di pezza=1 pezza.

12 denari di lira=1 soldo di lira.

20 soldi di lira=1 lira.

12. United States on Leghorn. Reduce 286 pezza, 10 soldi to federal money, exchange at 90 cents per pezza.

Ans. \$257.85.

13. Leghorn on the United States. Change \$257.85 to the currency of Leghorn.

Ans. 286 pezza, 10 soldi.

MILAN.

Accounts are kept in lire soldi, and denari correnti or imperiali.

12 denari=1 soldo.

20 soldi=1 lira.

106 soldi or lire imperiali=150 soldi or lire correnti=1 filippo.

117 soldi imperiali=1 scudo or crown.

14. United States on Milan. Change 176 lira, 10 soldi to federal money, the lira being valued at 20 cents. Ans. \$35.30.

15. Milan on the United States. Reduce \$35.30 to the currency of Milan.

Ans. 176 lira, 10 soldi.

NAPLES.

Computations are made in ducats of 100 grains.

10 grani=1 carlino.

10 carlini=1 ducato di regno.

16. United States on Naples. Change 769 ducati de regno, 5 carlini to federal money, the value of the ducato being 80 cents.
Ans. \$615.60.

17. Naples on the United States. Reduce \$615.60 to the currency of Naples. Ans. 769 ducati de regno, 5 carlini.

SICILY.

Accounts are kept here, in oncie, tari and grani; and also, in scudi, tari, and grani.

20 grani=1 tari.

30 tari=1 oncia.

Also, 12 tari=1 scudo or Sicilian crown.

5 scudi=2 oncia.

18. United States on Sicily. Change 876 oncia, 3 scudi to federal money, the oncia being valued at \$2.38.3.

Ans. \$2090.36.7.

19. Sicily on the United States. Change \$2090.36.7 to the currency of Sicily. Ans. 876 oncia, 3 scudi.

RUSSIA.

Computations are made here, in rubles and copecks.

10 copecks=1 griev or grievener.

10 grieves=1 ruble.

20. United States on Russia. What is the value of 7684 rubles, 8 grieves in federal money, the value of the ruble in the United States being 75 cents?
Ans. \$5763.60.

21. Russia on the United States. What is the value of \$5763.60 in Russian currency? Ans. 7684 rubles, 8 grieves.

ROME.

Accounts are kept in ecudi moneta, and bajocchi; or in scudi di stampa soldi, and denari d'oro quattrini, and mezzi quattrini are sometimes reckoned.

2 mezzi quattrini=1 quattrino.

5 quattrini=1 bajocco.

10 bajocchi=1 paolo.

10 paoli=1 scudo moneta, or Roman crown.

NOTE.—The exact proportion which the diameter of a circle bears to the circumference has never been discovered, although some mathematicians have carried it to 200 plans of decimals. If the diameter be 1 inch, the circumference will be 3.14159265358973238462613383279502884 nearly.

To find a square, that is exactly equal to a given circle, has never yet been discovered, and *probably never will*.

To find the content of a cube.

RULE.—Cube one of its sides for the contents.

14. If the side of a cube be 24 inches, what is its solidity, or content ? Ans. 13824 in.

15. How many cubic feet are there in a cube whose side is 18 inches ? Ans. $3\frac{3}{8}$ ft.

To find the solidity of a parallelopipedon.

RULE.—Multiply the length, breadth, and height continually together for the content.

16. What is the content of a parallelopipedon, whose length is 6 feet, breadth $2\frac{1}{2}$ feet, and altitude $1\frac{3}{4}$ feet ? Ans. $26\frac{1}{2}$ ft.

17. How many cubic feet in a block of marble, whose length is 3 feet 2 inches, breadth 2 feet 8 inches, and depth 2 feet 6 inches ? Ans. $21\frac{1}{3}$ ft.

To find the solidity of a prism.

RULE.—Multiply the area of the base, or end, by the height.

18. What is the content of a triangular prism, whose length is 12 feet, and each side of its equivalent base $2\frac{1}{2}$ feet ? Ans. $32.47\frac{1}{2}$ ft.

19. Required the solidity of a triangular prism, whose length is 10 feet, and the three sides of its triangular end, or base, are 5, 4, and 3 feet ? Ans. 60 ft.

20. Required the content of a cylinder, whose length is 20 feet, and circumference $5\frac{1}{2}$ feet ? Ans. $48.14\frac{1}{2}$ ft.

21. Required the convex surface of a cylinder, whose length is 20 feet, and its diameter 2 feet ? Ans. $125.663\frac{1}{2}$ ft.

To find the solidity of a cone, or pyramid.

RULE.—Multiply the area of the base by $\frac{1}{3}$ of its height.

22. What is the solidity of a cone, whose height is $12\frac{1}{2}$ feet, and the diameter of the base $2\frac{1}{2}$ feet ? Ans. $20.45\frac{1}{2}$ ft.

23. What is the content of a triangular pyramid, its height being 14 feet 6 inches, and the sides of its base 5, 6, and 7 feet ? Ans. $71.035\frac{1}{2}$ ft.

To find the surface of a cone.

RULE.—Multiply the circumference of the base by half its slant height.

24. What is the convex surface of a cone, whose side is 20 feet, and the circumference of its base 9 feet? Ans. 90ft.

To find the solidity of the frustrum of a cone, or pyramid.

RULE.—Divide the differences of the cubes of the diameters of the two ends, and by the difference of the diameters, and this quotient being multiplied by .7854; and again by $\frac{1}{3}$ of the height, or length, will give the solidity.

NOTE.—This is the exact rule for measuring round timber.

25. What is the content of a stick of timber, whose length is 40 feet, the diameter of the larger end 24 inches, and the smaller end 12 inches? Ans. 73 $\frac{1}{2}$ ft. nearly.

To find the solidity of a sphere or globe.

RULE.—Multiply the cube of the diameter by .5236.

26. What is the solidity of a sphere, whose axis or diameter is 12 inches? Ans. 904.78 $\frac{1}{2}$ in.

27. Required the content of the earth, supposing its circumference to be 25000 miles. Ans. 263858149120 miles.

To find the convex surface of a sphere, or globe.

RULE.—Multiply its diameter by its circumference.

28. Required the convex surface of a globe, whose diameter or axis is 24 inches. Ans. 1809.56 $\frac{1}{2}$ in.

29. Required the surface of the earth, its diameter being 7857 $\frac{1}{2}$ miles, and its circumference 25000 miles.

Ans. 198943750 square miles.

To find how large a cube may be cut from any given sphere, or be inscribed in it.

* **RULE.**—Square the diameter of the sphere, divide that product by 3, and extract the square root of the quotient for the answer.

DEMONSTRATION.—It is evident, that if a cube be inscribed in a sphere, its corners or angles will be in contact with the

* The author is not aware, that any other person but himself has ever discovered the truth of this rule; and although it has appeared in some recent publications, yet it was at his request.

22. United States on Rome. Change 7689 scudi moneta to federal money, the value of the scudi being \$1.00.0⁶⁷.

Ans. \$7694.15¹⁶³/₁₀₀₀.

23. Rome on the United States. Change \$7694.15¹⁶³/₁₀₀₀ to Roman currency.

Ans. 7689 scudo moneta.

SPAIN.

The general mode of keeping accounts in Spain, is in maravedis and reals.

34 maravedis=1 real.

8 reals=1 dollar of plate.

• 375 maravedis=1 ducat of exchange.

4 dollars of plate=1 pistole of exchange.

Exchanges are generally computed in denominations of plate, which is always understood to be *old plate*, if *new plate* be not mentioned.

There are three principal denominations of these imaginary moneys in which exchanges are generally transacted; viz., dollars, doubloons and ducats, and they are divided into reals and maravedis of plate, and sometimes converted into vellon and other denominations.

The dollar of exchange, also called *peso*, or *piastre de cambio*, or *de plata*, is divided into 8 reals of 34 maravedis of plate each, and sometimes into 16 quartos.

The *doubloon de plata*, or pistole of exchange, is four times the dollar, and therefore contains 32 reals, or 1088 maravedis of plate.

The ducat of plate, also called *ducado de cambio*, contains 11 reals 1 maravedi, or 375 maravedis of plate.

At Alicant, Valencia, and Barcelona, exchanges are transacted in libras of 20 sueldos, or 240 dineros.

The libra of Alicant and Valencia is the dollar of plate. This is sometimes divided into 10 reals of new plate, which are, of course, equal to 8 reals of old plate.

The libra of Barcelona, commonly called *libra catalan*, is worth 5½ reals of plate; hence 7 of those libras equal 5 dollars of plate, and therefore, 28 sueldos catalan equal 1 dollar.

The hard dollar of 20 reals vellon, is occasionally used in exchanges, and is also divided into 12 reals, each of 16 quartos. The current dollar, which is an imaginary money, valued at

two-thirds of the hard dollar, is divided into 8 reals, and the real into 16 quartos. The two latter are the principal moneys of exchange used at Gibraltar.

24. United States on Spain. What is the value in federal money of 76 dollars of plate, exchange at 75 cents for a plate dollar? Ans. \$5700.

25. Spain on the United States. What is the value of \$5700 in Spanish money, exchange at 75 cents per dollar of plate. Ans. 7600 dollars of plate.

SWEDEN.

Accounts are kept in rix dollars, skillings and fenings.

12 fenings=1 skilling.

48 skillings=1 rix dollar.

26. United States on Sweden. Reduce 476 rix dollars, 24 skillings to federal money, the rix dollar being valued at 107 cents. Ans. \$509.85.5.

27. Sweden on the United States. Change \$509.85.5 to the currency of Sweden. Ans. 476 rix dollars, 24 skillings.

TURIN.

Accounts are kept in lire, soldi and denari.

12 denari=1 soldi.

20 soldi=1 lira.

28. United States on Turin. Change 462 lira, 10 soldi to federal money, exchange at 20 cents per lira. Ans. \$92.50.

29. Turin on the United States. Change \$92.50 to the currency of Turin, exchange at 20 cents per lira. Ans. 452 lira, 10 soldi.

VIENNA.

Computations are made in florins and creutzers, or in rix dollars and creutzers.

4 pfenings=1 creutzer.

60 creutzers=1 florin.

1½ florins=1 rix dollar of account.

2 florins=1 " " specie.

30. United States on Vienna. Reduce 876 rix dollars, specie, 1 florin to federal money, the specie rix dollar being equal to 97 cents. Ans. \$850.20.

31. Vienna on the United States. Change \$850.20 to the currency of Vienna. Ans. 876 rix dollars, specie, 1 florin.

EAST INDIES.

BENGAL, CALCUTTA, ETC.

12 pice=1 anna.

16 annas=1 rupee.

1 sica rupee=2s. 6d. sterling.

32. United States on Calcutta. Reduce 432 rupees, 12 annas to federal money, exchange at 50 cents per rupee.

Ans. \$216.37½.

33. Calcutta on the United States. Reduce \$216.37½ to the currency of Calcutta, exchange at 50 cents per rupee.

Ans. 432 rupees, 12 annas.

BOMBAY.

100 rees=1 quarter.

4 quarters=1 rupee.

1 rupee=2s. 4d. sterling.

34. United States on Bombay. Change 678 rupees, 2 quarters to federal money, the rupee being 50 cents.

Ans. \$339.25.

35. Bombay on the United States. Change \$339.25 to Bombay money, reckoning the rupee at 50 cents.

Ans. 678 rupees, 2 quarters.

MADRAS.

Accounts are kept here, in pagodas, fanams, and cash.

80 cash=1 fanam.

45 fanams=1 star pagoda.

1 star pagoda=8s. sterling.

Ans. \$666.66+.

Ans. 504 pagodas.

Accounts are here kept, in pfenings, florins, and creutzers.

60 creutzers=1 florin.

1½ florins=1 rix dollar.

Ans. \$707.88g.

Ans. 769 rix dollars, 40 creutzers.

Accounts are here kept, in pounds, shillings, pence, and farthings, sterling. The principal coins are guineas and crowns, and their fractional parts.

Crown, 5 "

Ans. \$8067.62.

Ans. 197£ 14s. 9½d.

1728 | 8067.62¹⁶⁵ | ~~480~~ (4)
~~648~~
2155
6912
1004

2. Required the length of a pendulum, that shall vibrate 4 times a second. Ans. $2\frac{3}{5}$ in.

3. Required the length of a pendulum, that shall vibrate once a minute. Ans. 3920 yds.

4. How often will a pendulum vibrate, whose length is 100 feet? Ans. $5.53 + \text{sec.}$

PROBLEM II.

To find the weight of any body, at any assignable distance above the earth's surface.

The gravity of any body above the earth's surface *decreases*, as the squares of its distance in semi-diameters of the earth from its centre *increase*.

RULE.—As the square of the distance from the earth's centre is to the square of the earth's semi-diameter, so is the weight of the body on the earth's surface, to its weight at any assignable distance above the surface of the earth, and vice versa.

5. If a body weigh 900 pounds at the earth's surface, what would it weigh 2000 miles above its surface? Ans. 400 lbs.

6. Admitting the semi-diameter of the earth to be 4000 miles, what would be the weight of a body 20000 miles above its surface, that on its surface weighed 144 pounds?

Ans. 4 lbs.

7. How far must a body be raised to lose half of its weight? Ans. $1656.85 + \text{miles.}$

8. If a man at the earth's surface could carry 150 pounds, how much would that burthen weigh at the earth, which he could sustain at the distance of the moon, whose centre is 240000 miles from the earth's centre? Ans. 540000 lbs.

9. If a body at the surface of the earth weigh 900 pounds, but being carried to a certain height, weighs only 400 pounds; what is that height? Ans. 2000 miles.

PROBLEM III.

By having the height of a tide on the earth given, to find the height of one at the moon.

RULE.—As the cube of the moon's diameter multiplied by its density, is to the cube of the earth's diameter multiplied by

its density, so is the height of a tide on the earth, to the height of one at the moon.

10. If the attraction of the moon raise a tide at the earth 6 feet, what will be the height of a tide raised by the earth on the surface of the moon? Ans. 239.4ft.

PROBLEM IV.

To find the weight of a body at the sun and planets, having its weight given at the earth.

If the diameters of two globes be equal, and their diameter different, the weight of a body on their surfaces will be as their densities.

If their densities be equal, and their diameters different, the weight of a body will be as $\frac{1}{8}$ of their circumference.

If their diameters and densities be both different, the weight of a body will be as $\frac{3}{8}$ of their semi-diameters, multiplied by their densities.

Therefore, having the weight of a body on the surface of the earth given, to find its weight at the surface of the sun, and the several planets, we adopt the following

RULE.—As $\frac{3}{8}$ of the earth's semi-diameter, multiplied by its density, is to $\frac{3}{8}$ of the sun's, or planet's diameter, multiplied by its density, so is the weight of a body at the surface of the earth, to the weight of a body at the surface of the sun, or planet.

11. If the weight of a man at the surface of the earth be 170 pounds, what will be his weight at the surface of the sun, and the several planets, whose densities, &c. are as in the following table?

| | Density. | Diameter. | Semi-diam. | $\frac{3}{8}$ semi-diam. |
|----------|----------|-----------|------------|--------------------------|
| Sun, | 100 | 776970 | 388485 | 258990 |
| Jupiter, | 94.5 | 135079 | 67539.5 | 44693 |
| Saturn, | 67 | 98566 | 49283 | 32855.33 |
| Earth, | 400 | 6875 | 3437.5 | 2295 |
| Moon, | 494 | 1869.35 | 934.67 | 623.11 |

Ans. Weight at the Sun 4796lbs., at Jupiter 782lbs., at Saturn 407.6lbs., at the Moon 56.95lbs.

PROBLEM V.

To find how far a heavy body will fall in a given time, near the surface of the earth.

Heavy bodies near the surface of the earth fall 16 feet in one second of time; and the velocities they acquire in falling, are as the squares of the times; therefore, to find the distance any body will fall in a given time, we adopt the following

RULE.—As 1 second is to the square of the time in seconds, that the body is falling, so is 16 feet to the distance in feet, that the body will fall in the given time.

12. How far will a leaden bullet fall in 8 seconds ?

$1^2 : 8^2 :: 11\text{ft.} : 1024\text{ft.} = \text{Answer.}$

13. How far would a body fall in 1 minute ?

Ans. 10 miles, 1600yds.

14. How far would a body fall in one hour ?

Ans. 39272 miles, 128yds.

15. How far did the lost spirits fall in 9 days, in Milton's Paradise Lost ?

Ans. 18323095000 miles.

PROBLEM VI.

The velocity given to find the space fallen through to acquire that velocity.

RULE.—Divide the velocity by 8, and the square of the quotient will be the distance fallen through to acquire that velocity.

16. The velocity of a cannon ball is 660 feet per second, From what height must it fall to acquire that velocity ?

Ans. 6806½ft.

17. At what distance must a body have fallen to acquire the velocity of 1000 feet per second ?

Ans. 29 miles, 310ft.

PROBLEM VII.

The velocity given per second to find the time.

RULE.—Divide the velocity by 8, and a fourth part of the quotient will be the time in seconds.

18. How long must a body be falling to acquire a velocity of 200 feet per second ? Ans. $6\frac{1}{4}$ sec.

19. How long must a body be falling to acquire a velocity of 320 feet per second ? Ans. 10sec.

PROBLEM VIII.

The space through which a body has fallen, given to find the time it has been falling.

RULE.—Divide the square root of the space fallen through by 4, and the quotient will be the time in which it was falling.

20. How long would a body be falling through the space of 40000 feet ? Ans. 50sec.

21. How long would a ball be falling from the top of a tower, that was 400 feet high, to the earth ? Ans. 5sec.

PROBLEM IX.

The weight of a body and the space fallen through, given to find the force with which it will strike.

RULE.—Multiply the space fallen through by 64, then multiply the square root of this product by the weight, and the product is the momentum, or force with which it will strike.

22. If the rammer for driving the piles of Warren Bridge weighed 1000 pounds, and fell through a space of 16 feet, with what force did it strike the pile ?

$$\sqrt{16 \times 64} = 32 \qquad 32 \times 1000 = 32000 \text{ lbs. Answer.}$$

23. Bunker Hill Monument at this time, October 13, is about 64 feet high ; supposing a stone weighing 4 tons, should fall from its top to the earth, what would be its force, or momentum ? Ans. 573440lbs.

That is, it would strike the earth with more force, than the weight of 100 monuments of the same size and density.

MECHANICAL POWERS.

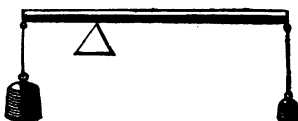
That body which communicates motion to another, is called the *power*.

The body which receives motion from another, is called the *weight*.

The mechanical powers are five, the Lever, the Wheel and Axle, the Pulley, the Inclined Plane, the Screw, and the Wedge.

LEVER.

The *lever* is a bar, movable about a fixed point, called its *fulcrum* or *prop*. It is in theory considered as an inflexible line, without weight. It is of three kinds; the first, when the prop is between the weight and the power; the second, when the weight is between the prop and the power; the third, when the power is between the prop and the weight.



A power and weight acting upon the arms of a lever, will balance each other, when the distance of the point, at which power is applied to the lever from the prop, is to the distance of the point at which the weight is applied, as the weight is to the power.

Therefore, to find what weight may be raised by a given power, we adopt the following

RULE.—As the distance between the body to be raised, or balanced, and the fulcrum or prop, is to the distance between the prop and the point, where the power is applied; so is the power to the weight which it will balance.

1. If a man weighing 170 pounds be resting upon a lever 10 feet long, what weight will he balance on the other end, supposing the prop one foot from the weight? Ans. 1530lbs.

2. If a weight of 1530 pounds were to be raised by a lever 10 feet long, and the prop fixed one foot from the weight, what power applied to the other end of the lever would balance it?

Ans. 170lbs.

3. If a weight of 1530 pounds be placed one foot from the prop, at what distance from the prop must a power of 170 pounds be applied to balance it?

Ans. 9ft.

4. At what distance from a weight of 1530 pounds must a prop be placed, so as that a power of 170 pounds, applied 9 feet from the prop, may balance it?

Ans. 1ft.

5. Supposing the earth to contain 4.000.000.000.000.000.000 cubic feet, and each foot to weigh 100 pounds, and that the earth was suspended at one end of a lever, its centre being 6000 miles from the fulcrum or prop; and that a man was able, at the other end of the lever, to pull, or press with a force of 200 pounds; what must be the distance between the man and the fulcrum, that he might be able to move the earth?

Ans. 12.000.000.000.0000.000.000.000.000. miles.

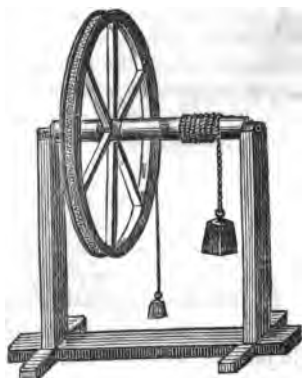
5. Supposing the man in the last question to be able to move his end of the lever 100 feet per second, how long would it take him to raise the earth one inch?

Ans. 52.813.479.690 years, 17 days, 12 hours, 57 min. 46 sec.

WHEEL AND AXLE.

The *wheel or axle* is a wheel turning round together with its axis; the power is applied to the circumference of the wheel, and the weight to that of the axis by means of cords.

An equilibrium is produced in the wheel and axis, when the wheel is to the power, as the diameter of the wheel to the diameter of its axis.



To find, therefore, how large a power must be applied to the wheel to raise a given weight on the axis, we adopt the following

RULE.—As the diameter of the wheel is to the diameter of the axle, so is the weight to be raised by the axle, to the power that must be applied to the wheel.

7. If the diameter of the axle be 6 inches, and the diameter of the wheel 4 feet, what power must be applied to the wheel to raise 960 pounds at the axle? Ans. 120lbs.

8. If the diameter of the axle be 6 inches, and the diameter of the wheel 4 feet, what power must be applied to the axle to raise 120 pounds at the wheel? Ans. 960lbs.

9. If the diameter of the axle be 6 inches, and 120 pounds applied to the wheel, raise 960 pounds at the axle, what is the diameter of the wheel? Ans. 4ft.

10. If the diameter of the wheel be 4 feet, and 120 pounds applied to the wheel, raise 960 pounds at the axle, what is the diameter of the axle? Ans. 6in.

PULLEY.

The *pulley* is a small wheel, movable about its axis by means of a cord, which passes over it.

When the axis of a pulley is fixed, the pulley only changes the direction of the power; if movable pulleys are used, an equilibrium is produced, when the power is to the weight, as one to the number of ropes applied to them. If each movable pulley has its own rope, each pulley will be double the power.



To find the weight, that may be raised by a given power.

RULE.—Multiply the power by twice the number of movable pulleys, and the product is the weight.

11. What power must be applied to a rope, that passes over one movable pulley, to balance a weight of 400 pounds?

Ans. 200lbs.

12. What weight will be balanced by a power of 10 pounds, attached to a cord that passes over 3 movable pulleys?

Ans. 60lbs.

13. What weight will be balanced by a power of 144 pounds, attached to a cord, that passes over two movable pulleys?

Ans. 576lbs.

14. If a cord, that passes over two movable pulleys be attached to an axle 6 inches in diameter; and if the wheel be 60 inches in diameter, what weight may be raised by the pulley, by applying 144 pounds to the wheel? Ans. 5760lbs.

INCLINED PLANE.

An *inclined plane* is a plane, which makes an acute angle with the horizon.

The motion of a body, descending down an inclined plane, is uniformly accelerated.

The force with which a body descends, by the force of attraction, down an inclined plane, is to that, with which it would descend freely, as the elevation of the plane to its length; or, as the size of its angle of inclination to radius.

To find the power, that will draw a weight up an inclined plane.

RULE.—Multiply the weight by the perpendicular height of the plane, and divide this product by the length.

15. An inclined plane is 50 feet in length, and 10 feet in perpendicular height; what power is sufficient to draw up a weight of 1000 pounds? Ans. 200lbs.

16. What weight applied to a cord passing over a single pulley at the elevated part of an inclined plane, will be able to sustain a weight of 1728 pounds, provided the plane was 600 feet long, and its perpendicular height 5 feet? Ans. 14 $\frac{2}{3}$ lbs.

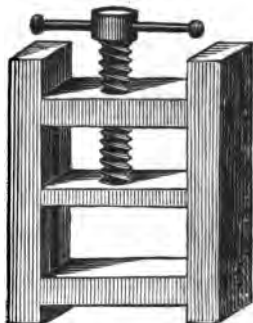
17. A certain rail-road, one mile in length, has a perpendicular elevation of 50 feet; what power is sufficient to draw a train of cars, weighing 20000 pounds, up this elevation?

Ans. 18 $\frac{1}{3}$ lbs.

THE SCREW.

The *screw* is a cylinder, which has either a prominent part, or a hollow line passing round it in a spiral form, so inserted in one of the opposite kind, that it may be raised or depressed at pleasure, with the weight upon its upper, or suspended beneath its lower surface.

In the *screw*, the equilibrium will be produced, when the power is to the weight, as the distance between the two contiguous threads, in a direction parallel to the axis of the screw, to the circumference of the circle described by the power in one revolution.



To find the power that should be applied to raise a given weight.

RULE.—As the distance between the threads of the screw is to the circumference of the circle described by the power, so is the power to the weight to be raised.

NOTE.—One third of the power is lost in overcoming friction.

18. If the threads of a screw be 1 inch apart, and a power of 100 pounds be applied to the end of a lever 10 feet long, what force will be exerted at the end of the screw ?

Ans. 75398.16 + lbs.

19. If the threads of a screw be $\frac{1}{4}$ an inch apart, what power must be applied to the end of a lever 100 inches in length to raise 100000 pounds ?

Ans. 79.5lbs.

20. If the threads of a screw be $\frac{1}{2}$ an inch apart, and a power of 79.5 pounds be applied to the end of a lever 100 inches in length, what will be raised ?

Ans. 100.000lbs.

21. If a power of 79.5 pounds be applied to the end of a lever 100 inches long; and if by this force a weight of 100.000 pounds be raised, what was the distance of the threads of the screw? Ans. $\frac{1}{2}$ an inch.

22. If a power of 79.5 pounds be applied to the end of a lever; and if by this force a weight of 100.000 pounds be raised, what must be the length of the lever, if the threads of the screw be $\frac{1}{2}$ an inch apart? Ans. 100in.

WEDGE.

The *wedge* is composed of two inclined planes, whose bases are joined.

When the resisting forces and the power which acts on the wedge, are in equilibrio, the weight will be to the power, as the height of the wedge to a line drawn from the middle of the base to one side, and parallel to the direction in which the resisting force acts on that side.

To find the force of the wedge.

RULE.—As the breadth or thickness of the head of the wedge is to one of its slanting sides, so is the power which acts against its head, to the force produced at its side.

23. Suppose 100 pounds to be applied to the head of a wedge, that was 2 inches broad, and 20 inches long, what force would be affected on each side? Ans. 1000lbs.

24. If a wedge be 12 inches long, and its head $1\frac{1}{2}$ inches broad; and if a screw whose threads are $\frac{3}{4}$ of an inch asunder, be applied to the head of this wedge; and if a power of 200 pounds were applied to the end of the lever, 16 feet long, what would be the force exerted on the sides of the wedge?

Ans. 2573590.5+lbs.

SPECIFIC GRAVITY.*

To find the specific gravity of a body.

RULE.—Weigh the body both in water and out of the water, and note the difference, which will be the weight lost in water; then, as the weight lost in water, is to the whole weight; so is the specific gravity of water to the specific gravity of the body. But if the body, whose specific gravity is required, is lighter than water, affix to it another body heavier than water, so that the mass, compounded of the two, may sink together. Weigh the dense body and the compound mass separately, both in water, and out of it; then find how much each loses in water by subtracting its weight in water from its weight in air; and subtract the less of these remainders from the greater; then say, as the last remainder is to the weight of the body in air, so is the specific gravity of water to the specific gravity of the body.

NOTE.—A cubic foot of water weighs 1000 ounces.

1. A stone weighed 10 pounds, but in water only $6\frac{1}{2}$ pounds. Required the specific gravity. Ans. 2609.

2. Suppose a piece of elm weigh 15 pounds in air, and that a piece of copper which weighs 18 pounds in air, and 16 pounds in water is affixed to it, and that the compound weighs 6 pounds in water. Required the specific gravity of the elm. Ans. 600.

MISCELLANEOUS QUESTIONS.

1. What fraction is that, from which, if $\frac{7}{8}$ be taken, the remainder will be $\frac{1}{8}$? Ans. $\frac{7}{8}$.

2. What number must $7\frac{3}{4}$ be multiplied by, that the product may be $6\frac{3}{4}$? Ans. $\frac{5}{7}$.

* The specific gravity of a body is its weight compared with water; the water being considered 1000.

3. What quantity is that, which being multiplied by $7\frac{1}{2}$, the product shall be $7\frac{1}{2}$? Ans. $\frac{1}{3}$.

4. What number is that, which being multiplied by half itself, the product shall be $4\frac{1}{2}$? Ans. 3.

5. What part of $7\frac{3}{4}$ is $9\frac{1}{4}$? Ans. $\frac{3}{11}$.

6. What fraction is that, which being divided by $11\frac{3}{4}$, the quotient shall be 5? Ans. $57\frac{1}{4}$.

7. If $\frac{1}{4}$ of a gallon of molasses cost 10 cents, what will 19 $\frac{3}{4}$ gallons cost? Ans. \$3.375.

8. If $\frac{1}{11}$ of a hogshead of wine cost \$27.27, what is the value of a hogshead? Ans. \$42.85 $\frac{1}{2}$.

9. If $\frac{1}{3}$ of a piece of linen cost \$18.17, what cost 11 $\frac{1}{2}$ pieces? Ans. \$68.33 $\frac{2}{3}$.

10. Lent \$75 for 7 months, how long shall I keep \$25 to balance the favor? Ans. 21 months.

11. If 12 men in 5 days can mow a field of 100 acres, how many acres can 7 men mow in 12 days? Ans. 140 acres.

12. Reduce $\frac{341}{46}$ to a single fraction. Ans. $\frac{3}{4}$.

13. Reduce $\frac{7}{19\frac{3}{4}}$ to a single fraction. Ans. $\frac{5}{14}$.

14. What part of \$180 is \$140? Ans. $\frac{7}{9}$.

15. Add $\frac{1}{4}$ of a ton to $\frac{2}{10}$ of a cwt. Ans. 12cwt. 1qr. 8 $\frac{1}{2}$ lbs.

16. If the earth make one complete revolution in 23 hours, 56 minutes, 3 seconds, in what time does it move one degree? Ans. 3m. 59" 20".

17. What number is that to which, if $\frac{2}{3}$ of $\frac{5}{8}$ be added, the sum will be 1? Ans. $\frac{5}{8}$.

18. A, B, and C are to share \$100.000 in the proportion of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ respectively; but C's part being lost by his death, it is required to divide the whole sum, properly, between the other two. Ans. A's part is \$57142 $\frac{2}{3}$, and B's \$42857 $\frac{1}{3}$.

19. A gentleman being asked what o'clock it was, said that it was between 5 and 6; but to be more particular, he said that the minute hand had past as far beyond the 6, as the hour hand wanted of being to the 6; that is, that the hour and minute hands made equal acute angles, with a line passing from the 12 through the 6. Required the time of day.

Ans. 36m. 55 $\frac{5}{13}$ sec. past 5.

20. A certain gentleman at the time of marriage agreed to give his wife $\frac{3}{8}$ of his estate, if at the time of his death he left only a daughter, and if he left only a son, she should have $\frac{1}{2}$ of his property; but, as it happened, he left a son and a daughter, by which the widow lost in equity \$2400 more than if there had been only a daughter. What would have been his wife's dowry if he had left only a son? Ans. \$2100.

21. A father devised $\frac{7}{8}$ of his estate to one of his sons, and $\frac{1}{8}$ of the residue to the other, and the remainder to his wife. The difference of his son's legacies was found to be 257£ 3s. 4d. What money did he leave for his widow?

Ans. 635£ 0s. 10½d.

22. In the walls of Balbeck, in Turkey, the antient Heliopolis, there are three stones laid end to end, now in sight, that measure in length 61 yards; one of which is 63 feet long, 12 feet thick, and 12 feet broad; what is the weight, supposing its specific gravity to be 3 times that of water? Ans. 759½ tons.

23. Two men carrying a burden of 200 pounds, hung on a pole, the ends of which rest on their shoulders; how much of this load is borne by each man, the weight hanging 6 inches from the middle, and the whole length of the pole being 6 feet?

Ans. 125lbs., and 75lbs.

24. The new Court-House in Boston, has 8 pillars of granite, that are 25 feet 4 inches in length, 4 feet 5 inches in diameter at one end, and 3 feet 5 inches in diameter at the other end. How many cubic feet do they contain, and what is their weight, allowing a cubic foot to weigh 3000 ounces?

Ans. 2455.05 cubic feet, 205.5 tons.

25. A father dying, left his son a fortune, $\frac{1}{4}$ of which he spent in 8 months; $\frac{3}{4}$ of the remainder lasted him 12 months longer; after which he had only \$410 left. What did his father bequeath him?

Ans. \$956.66½.

26. A merchant has sold goods to a certain amount, on a commission of 4 per cent., and having remitted the nett proceeds to the owner, he received $\frac{1}{4}$ per cent. for prompt payment, which amounted to \$15.60. What was the amount of his commission?

Ans. \$260.00.

27. A, of Boston, remits to B, of New York, a bill of Exchange on London, the avails of which he wishes to be invested in goods on his account. B having disposed of the bill at 7½ per cent. advance, he received \$9675.00, and having reserved for himself $\frac{1}{4}$ per cent. on the sale of the bill, and 2 per cent. for commission; what will remain for investment, and for how much was the bill drawn? Ans. For investment, \$9461.58½.

The bill was 2025£.

28. Bunker Hill Monument is 30 feet square at its base, and is to be 15 feet square at its top; its height is to be 220. From the bottom to the top, through its centre, is a cylindrical avenue 15 feet in diameter at the bottom, and about 11 feet at the top. How many cubic feet will there be in the monument?

Ans. 86069ft.

29. A hired a house for one year for \$300; at the end of 4 months he takes in M as a partner, and at the end of 8 months he takes in P. At the end of the year, what rent must each pay? Ans. A pays \$183 $\frac{1}{3}$, M pays \$83 $\frac{1}{3}$, P pays \$33 $\frac{1}{3}$.

30. A merchant receives on commission, three kinds of flour; from A he receives 20 barrels, from P 25 barrels, and from C 40 barrels. He finds that A's flour is 10 per cent. better than B's, and that B's is 20 per cent. better than C's. He sells the whole at \$6 per barrel. What in justice should each man receive?

Ans. A receives \$139 $\frac{16}{41}$, B \$158 $\frac{11}{41}$, C 211 $\frac{14}{41}$.

31. Bought 100 barrels of flour, at \$5.00 per barrel, and immediately sold it on a credit of 6 months. The note which I received for pay, I got discounted at the Suffolk Bank; and, on examining my money, I found that I had gained 20 per cent. on my purchase. What did I receive per barrel for the flour?

Ans. \$6.31 $\frac{5}{8}$.

32. Purchased for a cloak 5 $\frac{1}{4}$ yards of broadcloth, that was 1 $\frac{7}{8}$ yards wide; to line this I purchased flannel, that was $\frac{7}{8}$ yards wide, but on being wet it shrunk 1 nail in width, and 1 yard in every 20 yards in length. How many yards of flannel was it necessary to buy?

Ans. 12 $\frac{1}{2}$ $\frac{8}{9}$ yds.

33. How many bricks would it require to build the walls of a house 40 feet long, 30 feet wide, and 20 feet high, admitting the walls to be a foot thick, and that each brick was 8 inches long, 4 inches wide, and 2 inches thick?

Ans. 73440 bricks.

34. How many feet of boards would it require to cover a house, that was 40 feet square, and whose height to the top of the plate was 20 feet. The roof projected 1 foot over the plate, and came to a point over the centre of the house, 15 feet above the garret floor?

Ans. 5367.7+.

35. The dimensions of a bushel measure are 18 $\frac{1}{2}$ inches wide, and 8 inches deep; what should be the dimension of a similar measure, that would contain 8 bushels?

Ans. 37in. wide. 16in. deep

36. What is the weight of a hollow spherical iron shell 5 inches in diameter, the thickness of the metal being 1 inch, and a cubic inch of iron, weighing $\frac{1}{16}$ of a pound?

Ans. 13.2387lbs.

37. How much larger is a cube, that will contain a globe of 20 inches in diameter, than a cube inscribed within such globe?

Ans. Larger cube 8000in., smaller 1539in.

38. If in a pair of scales, a body weigh 90 pounds in one scale, and only 40 pounds in the other. Required the true weight, and the proportion of the lengths of the two arms of the balance beam on each side of the point of suspension.

Ans. The weight 60lbs., and the proportions 3 to 2.

39. In turning a one-horse chaise within a ring of a certain diameter, it was observed that the outer wheel made two turns, while the inner wheel made but one; the wheels were both four feet high; and supposing them both fixed, at the distance of five feet asunder on the axletree; what was the circumference of the track described by the outer wheel?

Ans. 62.83+ft.

40. The ball on the top of St. Paul's Church is 6 feet in diameter. What did the gilding of it cost at 3½d. per square foot?

Ans. 237£ 10s. 1d.

41. There is a conical glass, 6 inches high, 5 inches wide at the top, and 6 inches deep; it is $\frac{1}{2}$ part filled with water. What must be the diameter of a ball, let fall into the water, that shall be immersed by it?

Ans. 2.445+in.

42. A certain lady, the mother of three daughters, had a farm of 500 acres, in a circular form, with her dwelling-house in the centre. Being desirous of having her daughters settled near her, she gave to them three equal parcels, as large as could be made in three equal circles, included within the periphery of her farm, one to each, with a dwelling-house in the centre of each; that is, there were to be three equal circles, as large as could be made within a circle, that contained 500 acres. How many acres did the farm of each daughter contain; how many acres did the mother retain; how far apart were the dwelling-houses of the daughters; and how far was the dwelling-house of each daughter from that of the mother?

Ans. Each daughter's farm contained 108ac. 88½rds. The mother retained 174ac., 54½rds. The distance of one daughter's house to the other, was 148.7+rds. The mother's dwelling-house was distant from her daughters' 85.22+rds.

A
NEW AND CONCISE SYSTEM
OF
BOOK-KEEPING,
BY
SINGLE AND DOUBLE ENTRY
CALCULATED FOR THE VARIOUS BRANCHES OF
FOREIGN AND DOMESTIC TRADE.
DESIGNED FOR THE USE OF SCHOOLS AND ACADEMIES.

BY BENJAMIN GREENLEAF, A. M.
Preceptor of Bradford Academy.

BOSTON:
PUBLISHED BY ROBERT S. DAVIS.
.....
1835.



BOOK-KEEPING.

BOOK-KEEPING is the art of recording mercantile transactions.

Two methods have been usually adopted; *Single* and *Double Entry*.

In *Single Entry*, two books are necessary, the *Day* or *Waste-Book*, and *Leger*; others are occasionally used.

DAY BOOK.

This book commences with an inventory of all the property invested in trade; viz. money, notes, goods, &c.; and also, an account of all the debts which the merchant owes.

After the inventory, the daily occurrences of trade should be narrated one after the other, according to their dates; such as buying, selling, receiving, paying, &c.

In entering which, every circumstance that respects the transaction, should be clearly and distinctly expressed; such as the names of the parties, the conditions of bargains, the terms of payment, the quantity, quality, and price of goods, with every thing else, that is material or expressive of the nature and design of the transaction.

Dr. and Cr. may be easily distinguished by the following rules.

1. The person to whom goods are sold on credit is Dr.
2. The person of whom goods are bought on credit is Cr.
3. The person to whom money is paid is Dr.
4. The person from whom money is received is Cr.

5. The person to whom the merchant, in any way becomes indebted, is entered Cr.

6. The person, who in any way becomes indebted to the merchant, is entered Dr.

7. The receiver is Dr., and the giver is Cr.

THE LEGER.

The Leger is the merchant's principal book, as in it are collected the scattered accounts of the Waste Book, and disposed in spaces assigned for them.

RULES FOR POSTING THE LEGER.

Enter the several transactions on the debtor and creditor side in the Leger, as they stand debited or credited in the Day Book.

When all the transactions are correctly posted into the Leger, each account is balanced by subtracting the less side from the greater, entering the balance on the less side, by which both sides will be made equal.

Boston, January 1, 1835.

| L. F. | | \$ | C: |
|-------|--|----------|----|
| | INVENTORY. | | |
| | Inventory of goods, money, and debts due to James Williams, merchant, Boston. | | |
| | Money on hand | \$1000 | |
| | Various merchandise | 3000 | |
| 1 | Daniel Snow owes me | 100 | |
| 3 | James George " " | 200 | |
| | | 4300 | 00 |
| | " " | | |
| | DEBTS OWED. | | |
| 3 | To John Dole, on account | \$150.00 | |
| 1 | James Ames | 200.00 | |
| | | 350 | 00 |
| | 2 | | |
| 1 | John True | Dr. | |
| | To 7 lbs. coffee | a .14 | |
| | 9 lbs. tea | a .38 | |
| | 50 lbs. fish | a .05 | |
| | | 6 | 90 |
| | 3 | | |
| 1 | Daniel Snow | Dr. | |
| | To 9 yards white flannel | a \$.66 | |
| | 7 lbs. colored thread | a .98 | |
| | 4 silk vests | a 3.75 | |
| | 6 ivory combs | a .30 | |
| | | 29 | 60 |
| | 5 | | |
| 1 | Samuel Brown | Dr. | |
| | To 10 lbs. hyson tea | a .38 | |
| | 17 " coffee | a .14 | |
| | 16 yards durant | a .40 | |
| | 15 " white flannel | a .67 | |
| | | 22 | 63 |
| | 6 | | |
| 1 | James Ames | Dr. | |
| | To 7 galls. wine | a \$1.25 | |
| | 1 barrel oil | a 23.82 | |
| | | 32 | 57 |

Boston, January 7, 1835.

| L. F. | | \$ | C. |
|-------|--|-----|----|
| 1 | Samuel Brown Cr. | | |
| | By 19 pair shoes a \$1.75 | | |
| | 12 " boots a 2.25 | | |
| | 6 silk vests a 3.18 | | |
| | 7 cords wood a 5.17 | | |
| | | 115 | 52 |
| | 8 | | |
| 1 | Enoch Carey Dr. | | |
| | To 16 lbs. coffee a .25 | | |
| | 8 " sugar a .11 | | |
| | 15 " hyson tea a .42 | | |
| | 24 " loaf sugar a .17 | | |
| | | 15 | 26 |
| | 9 | | |
| 1 | Daniel Snow Cr. | | |
| | By 16 bushels corn a \$.83 | | |
| | 7 " rye a 1.13 | | |
| | | 21 | 19 |
| | 10 | | |
| 2 | John Day Dr. | | |
| | To 1 bale cotton, 300 yards a \$.09 | | |
| | 1 " shirting, 400 " a .15 | | |
| | 1 ps. cassimere, 20 " a 1.25 | | |
| | | 112 | 00 |
| | 12 | | |
| 2 | Luke Frye Dr. | | |
| | To 2 yards broadcloth a \$4.25 | | |
| | silk a .87 | | |
| | 2 pair gloves a .75 | | |
| | | 10 | 87 |
| | 13 | | |
| 1 | John True Cr. | | |
| | By cash 3 00 | 3 | 00 |
| | 14 | | |
| 2 | Mark George Dr. | | |
| | To 14 lbs. sugar a .12 | | |
| | 16 " coffee a .15 | | |
| | 12 " butter a .16 | | |
| | | 6 | 00 |

Boston, January 15, 1835.

| L. F. | | | \$ | C. |
|-------|----------------------------------|----------|----|----|
| | | | | |
| 2 | John How | Dr. | | |
| | To 275 lbs. fish | a .03 | | |
| | 50 " ginger | a .16 | | |
| | 23 " pepper | a .24 | | |
| | | | 21 | 77 |
| | 16 | | | |
| 2 | John Day | Cr. | | |
| | By cash on account | | 85 | 00 |
| | 17 | | | |
| 3 | Samuel Ives | Dr. | | |
| | To 4 umbrellas | a \$1.25 | | |
| | 9 yards bombazine | a .45 | | |
| | 5 " satinett | a .50 | | |
| | | | 11 | 55 |
| | 19 | | | |
| 3 | Daniel Jones | Dr. | | |
| | To 4 yards broadcloth | a \$5.25 | | |
| | 14 " linen | a .15 | | |
| | trimmings | a 1.50 | | |
| | | | 24 | 60 |
| | 20 | | | |
| 3 | James George | Dr. | | |
| | To 6 galls. molasses | a .30 | | |
| | 25 lbs. flour | a .05 | | |
| | 10 " raisins | a .10 | | |
| | | | 4 | 05 |
| | 21 | | | |
| 1 | Enoch Carey | Cr. | | |
| | By 16 sides leather, 24lbs. | a .20 | | |
| | 20 lbs. calfskin | a .45 | | |
| | | | 85 | 80 |
| | 22 | | | |
| 1 | Daniel Snow | Dr. | | |
| | To 17 yards cambric | a \$.44 | | |
| | 5 worsted shawls | a 1.50 | | |
| | | | 14 | 98 |

Boston, January 23, 1835.

| L. F. | | | \$ | C. |
|-------|---|-----|----|----|
| 2 | John Day | Cr. | | |
| | By order on Jacob Flint | | 20 | 00 |
| | 24 | | | |
| 1 | James Ames | Dr. | | |
| | To 5 yards brown linen. a \$.30 | | | |
| | 9 " plaid print. a .29 | | | |
| | 3 " silk velvet a 2.50 | | | |
| | | | 11 | 61 |
| | 26 | | | |
| 2 | John Day | Dr. | | |
| | To 1 bale shirting, 500 yards a 10 | | 50 | 00 |
| | 27 | | | |
| 2 | John How | Cr. | | |
| | By cash on account | | 20 | 00 |
| | 28 | | | |
| 1 | Samuel Brown | Dr. | | |
| | To 7 yards broadcloth a \$5.50 | | | |
| | 5 " cassimere a 1.50 | | | |
| | 10 " jean a .20 | | | |
| | | | 48 | 00 |
| | 29 | | | |
| 2 | Luke Frye | Dr. | | |
| | To 3 yards kersey a \$1.00 | | | |
| | 8 " flannel a .37 1-2 | | | |
| | | | 6 | 00 |
| | 30 | | | |
| 2 | Mark George | Dr. | | |
| | To 1 keg molasses, 10 gals. a \$.35 | | | |
| | 1 bbl. flour a 6.75 | | | |
| | | | 10 | 25 |
| | 31 | | | |
| 1 | John True | Cr. | | |
| | By 1 load wood, 1 1-2 cords \$ 4.50 | | 6 | 75 |
| | February 2 | | | |
| 3 | Samuel Ives | Dr. | | |
| | To 2 pair boots a \$3.00 | | | |
| | 1 " shoes a 1.25 | | | |
| | | | 7 | 25 |

Boston, February 3, 1835.

| L. F. | | \$ | C. |
|-------|--------------------------------------|----|-------|
| 3 | Daniel Jones Dr. | | |
| | To 14 yards tow cloth a \$.09 | | |
| | 3 " brown linen..... a .25 | | |
| | 2 pieces nankin a 1.87 | | |
| | 8 yards striped jean a .17 | | |
| | | | |
| | _____ 4 _____ | | 7 11 |
| 3 | James George Dr. | | |
| | To 3 bushels corn a .85 | | |
| | 2 " rye a .92 | | |
| | 8 " oats a .33 | | |
| | | | |
| | _____ 5 _____ | | 7 03 |
| 2 | John Day Cr. | | |
| | By cash on account 50 00 | | |
| | | | |
| | _____ 7 _____ | | |
| 1 | John True Dr. | | |
| | To 3 bbls. flour a \$5.50 | | |
| | 15 lbs. cheese a .13 | | |
| | 18 " raisins..... a .08 | | |
| | 15 " pepper..... a .17 | | |
| | | | |
| | _____ 9 _____ | | 22 44 |
| 1 | Samuel Brown Dr. | | |
| | To 1 bbl. flour a \$5.60 | | |
| | 7 lbs. green tea..... a .39 | | |
| | 5 " sugar..... a .12 | | |
| | | | |
| | _____ 10 _____ | | 8 86 |
| 1 | John True Cr. | | |
| | By cash on account..... 20 00 | | |
| | | | |
| | _____ 11 _____ | | |
| 1 | Daniel Snow Dr. | | |
| | To 30 lbs. sugar a .12 | | |
| | 70 " flour a .06 | | |
| | 5 " raisins..... a .10 | | |
| | | | |
| | _____ 11 _____ | | 8 30 |

Boston, February 12, 1835.

| L. F. | | \$ | C. |
|-------|-----------------------------|----------|--------|
| 1 | Samuel Brown | Cr. | |
| | By cash on account..... | | 30 00 |
| | 13 | | |
| 1 | Daniel Snow | Cr. | |
| | By 40 bushels salt..... | a \$.45 | |
| | 37 " rye | a 1.75 | |
| | 15 " corn | a 1.12 | |
| | | | 99 55 |
| | 14 | | |
| 1 | John True | Cr. | |
| | By cash on account..... | | 10 00 |
| | 16 | | |
| 2 | John Day | Dr. | |
| | To 7 yards broadcloth | a \$3.75 | |
| | 6 " calico | a .17 | |
| | 12 lbs. sugar | a .17 | |
| | | | 29 31 |
| | 17 | | |
| 1 | Enoch Carey | Dr. | |
| | To 15 lbs. sugar | a .09 | |
| | 16 " tea | a .65 | |
| | 3 bushels salt | a .47 | |
| | | | 13 16 |
| | 18 | | |
| 2 | John Day | Cr. | |
| | By cash on account..... | | 12 00 |
| | 19 | | |
| 1 | James Ames | Dr. | |
| | To 7 bbls. flour | a \$5.60 | |
| | 8 bushels salt..... | a .81 | |
| | 81 " rye..... | a 1.25 | |
| | | | 146 93 |
| | 20 | | |
| 1 | Enoch Carey | Dr. | |
| | To 3 cords wood | a \$5.50 | |
| | 18 tons timber | a 7.80 | |
| | | | 156 90 |

Boston, February 21, 1835.

| L. F. | | \$ | C. |
|-------|--------------------------------------|----|----|
| 2 | Luke Frye Dr. | | |
| | To 8 yards broadcloth a \$5.75 | 46 | 00 |
| | _____ 23 _____ | | |
| 2 | Mark George Cr. | | |
| | By 7 cords oak wood a \$6.75 | 47 | 25 |
| | _____ 24 _____ | | |
| 2 | Mark George Dr. | | |
| | To 17 lbs. butter..... a .25 | | |
| | 18 " coffee..... a .16 | | |
| | 30 " cheese..... a .12 | | |
| | _____ 25 _____ | 10 | 73 |
| 2 | Mark George Cr. | | |
| | By 15 bushels salt..... a \$.30 | | |
| | 14 " rye a 1.67 | | |
| | _____ 26 _____ | 35 | 38 |
| 2 | John How Dr. | | |
| | To 10 yards ticking..... a .25 | | |
| | 16 " shirting..... a .18 | | |
| | _____ 27 _____ | 5 | 38 |
| 2 | Luke Frye Dr. | | |
| | To 5 yards linen a \$.80 | | |
| | 8 " full cloth..... a 1.65 | | |
| | 7 " bombazine a .45 | | |
| | _____ 28 _____ | 20 | 35 |
| 2 | John How Cr. | | |
| | By cash a | 45 | 00 |
| | _____ " _____ | | |
| 2 | Luke Frye Cr. | | |
| | By 5 bushels apples a \$1.45 | | |
| | 3 " walnuts..... a 1.75 | | |
| | _____ | 12 | 50 |

Boston, March 2, 1835.

| L. F. | | | \$ | C. |
|-------|--------------------------------|-----|--------|----|
| | | | | |
| 1 | John True | Dr. | | |
| | To 28 yards broadcloth | a | \$5.60 | |
| | 15 bbls. flour | a | 6.70 | |
| | 90 galls. molasses..... | a | .46 | |
| | 14 lbs. coffee | a | .15 | |
| | | | 300 | 80 |
| | 3 | | | |
| 1 | James Ames | Cr. | | |
| | By 46 bushels corn | a | \$1.12 | |
| | 17 " rye | a | 1.25 | |
| | 30 " wheat..... | a | 1.50 | |
| | | | 117 | 77 |
| | 4 | | | |
| 1 | Enoch Carey | Cr. | | |
| | By 7 cords oak wood..... | a | \$5.50 | |
| | 18 lbs. clover seed | a | .10 | |
| | | | 40 | 30 |
| | 5 | | | |
| 1 | James Ames | Cr. | | |
| | By cash | | 73 | 34 |
| | 6 | | | |
| 2 | Luke Frye | Cr. | | |
| | By cash | | 50 | 00 |
| | 7 | | | |
| 2 | Mark George | Cr. | | |
| | By 1 cord wood | a | \$5.67 | |
| | | | 5 | 67 |
| | 9 | | | |
| 3 | Samuel Ives | Cr. | | |
| | By 17 bushels beans..... | a | \$1.50 | |
| | 18 " corn..... | a | 1.12 | |
| | | | 45 | 66 |
| | 10 | | | |
| 3 | Daniel Jones | Cr. | | |
| | By an order on John Wait | | 30 | 00 |
| | 11 | | | |
| 3 | Samuel Ives | Cr. | | |
| | By an order on John Ames | | 5 | 00 |
| | 12 | | | |
| 3 | James George | Cr. | | |
| | By cash on account..... | | 10 | 00 |

Boston, March 13, 1835.

| L. | F. | | | \$ | C. |
|----|----|------------------------|-----|--------|----|
| 3 | | Daniel Jones | Cr. | | |
| | | By 1 ton hay | | 15 | 00 |
| | | 14 | | | |
| 3 | | James George | Cr. | | |
| | | By 7 days' labor | a | \$1.25 | |
| | | 1 bushel corn | a | 1.25 | |
| | | | | 10 | 00 |

INDEX TO THE LEGER.

| | A | Fol. | | B | Fol. |
|--------------------|---|------|--------------------|---|------|
| Ames James | | 1 | Brown Samuel | | 1 |
| | C | | | D | |
| Carey Enoch | | 1 | Day John | | 2 |
| | | | Dole John | | 3 |
| | F | | | G | |
| Frye Luke | | 2 | George James | | 3 |
| | | | George Mark | | 2 |
| | H | | | I | |
| How John | | 2 | Ives Samuel | | 3 |
| | J | | | S | |
| Jones Daniel | | 3 | Snow Daniel | | 1 |
| | T | | | | |
| True John | | 1 | | | |

Dr. John True.

| 1835. | JF | | \$ | C. |
|-------|----|---|-----------------------------------|--------|
| Jan. | 2 | 1 | To sundries as per day book | 6 90 |
| Feb. | 7 | 5 | Sundries | 22 44 |
| March | 2 | 8 | Sundries | 300 80 |
| | | | | <hr/> |
| | | | 330 | 14 |

Dr. Daniel Snow.

| 1835. | JF | | \$ | C. |
|-------|----|---|----------------|--------|
| Jan. | | 1 | To stock | 100 00 |
| | 3 | 2 | Sundries | 29 60 |
| | 22 | 3 | Sundries | 14 98 |
| Feb. | 11 | 5 | Sundries | 8 30 |
| | | | | <hr/> |
| | | | 152 | 88 |

Dr. Samuel Brown.

| 1835. | JF | | \$ | C. |
|-------|----|---|---------------------------|-------|
| Jan. | 5 | 1 | To sundries | 22 63 |
| | 28 | 4 | Sundries | 48 00 |
| Feb. | 9 | 5 | Sundries | 8 86 |
| | | | Balance transferred | 66 03 |
| | | | | <hr/> |
| | | | 145 | 52 |

Dr. James Ames.

| 1835. | JF | | \$ | C. |
|-------|----|---|---------------------------|--------|
| Jan. | 6 | 1 | To sundries | 32 57 |
| | 24 | 4 | Sundries | 11 61 |
| Feb. | 19 | 6 | Sundries | 146 93 |
| | | | Balance transferred | 200 00 |
| | | | | <hr/> |
| | | | 191 | 11 |

Dr. Enoch Carey.

| 1835. | JF | | \$ | C. |
|-------|----|---|-------------------|--------|
| Jan. | 8 | 2 | To sundries | 15 26 |
| Feb. | 17 | 6 | Sundries | 13 16 |
| | 20 | 6 | Sundries | 156 90 |
| | | | | <hr/> |
| | | | 185 | 32 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|---------------------------|----|-----|----|
| Jan. | 13 | By cash | 2 | 3 | 00 |
| | 31 | A load of wood | 4 | 6 | 75 |
| Feb. | 10 | Cash on account | 6 | 20 | 00 |
| | 14 | Cash on account | 5 | 10 | 00 |
| | | Balance transferred | | 290 | 39 |
| | | | | 330 | 14 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|---------------------------|----|-----|----|
| Jan. | 9 | By sundries | 2 | 21 | 19 |
| Feb. | 13 | Sundries | 6 | 99 | 55 |
| | | Balance transferred | | 32 | 14 |
| | | | | 152 | 88 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|-----------------------|----|-----|----|
| Jan. | 7 | By sundries | 2 | 115 | 52 |
| Feb. | 12 | Cash on account | 6 | 30 | 00 |
| | | | | 145 | 52 |

Cr.

| 1835. | | | | \$ | C. |
|-------|---|----------------|---|-----|----|
| Jan. | 1 | By stock | 1 | 200 | 00 |
| March | 3 | Sundries | 3 | 117 | 77 |
| | 5 | Cash | 8 | 73 | 34 |
| | | | | 191 | 11 |

Cr.

| 1835. | | | | \$ | C. |
|-------|----|---------------------------|---|-----|----|
| Jan. | 21 | By sundries | 3 | 85 | 80 |
| March | 4 | Sundries | 3 | 40 | 30 |
| | | Balance transferred | | 59 | 22 |
| | | | | 185 | 32 |

Dr. John Day.

| 1835. | J | F | | \$ | C. |
|-------|----|---|-----------------------|-----|----|
| Jan. | 10 | 2 | To sundries | 112 | 00 |
| | 26 | 4 | Bale of shirting..... | 50 | 00 |
| Feb. | 16 | 6 | Sundries | 29 | 31 |
| | | | | 191 | 31 |

Dr. Luke Frye.

| 1835. | J | F | | \$ | C. |
|-------|----|---|--------------------------|----|----|
| Jan. | 12 | 2 | To sundries | 10 | 87 |
| | 29 | 4 | Sundries | 6 | 00 |
| Feb. | 21 | 7 | 8 yards broadcloth | 46 | 00 |
| | 21 | 7 | Sundries | 20 | 35 |
| | | | | 83 | 22 |

Dr. Mark George.

| 1835. | J | F | | \$ | C. |
|-------|----|---|---------------------------|----|----|
| Jan. | 14 | 2 | To sundries | 6 | 00 |
| | 30 | 4 | Sundries | 10 | 25 |
| Feb. | 24 | 7 | Sundries | 10 | 73 |
| | | | Balance transferred | 61 | 32 |
| | | | | 88 | 30 |

Dr. John How.

| 1835. | J | F | | \$ | C. |
|-------|----|---|---------------------------|----|----|
| Jan. | 15 | 3 | To sundries..... | 21 | 77 |
| Feb. | 26 | 7 | Sundries | 5 | 38 |
| | | | Balance transferred | 37 | 85 |
| | | | | 65 | 00 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|---------------------------|----|-----|----|
| Jan. | 16 | By Cash on account | 3 | 85 | 00 |
| | 23 | Order on Jacob Fint | 4 | 20 | 00 |
| Feb. | 5 | Cash on account | 5 | 50 | 00 |
| | 18 | Cash on account | 6 | 12 | 00 |
| | | Balance transferred | | 24 | 31 |
| | | | | 191 | 31 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|---------------------------|----|----|----|
| Feb. | 28 | By sundries | 7 | 12 | 50 |
| March | 6 | Cash | 8 | 50 | 00 |
| | | Balance transferred | | 20 | 72 |
| | | | | 83 | 22 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|-----------------------|----|----|----|
| Feb. | 23 | By 7 cords wood | 7 | 47 | 24 |
| | 25 | Sundries | 7 | 35 | 38 |
| March | 7 | 1 cord wood | 8 | 5 | 67 |
| | | | | 88 | 30 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|--------------------------|----|----|----|
| Jan. | 27 | By cash on account | 4 | 20 | 00 |
| Feb. | 28 | Cash | 7 | 45 | 00 |
| | | | | 65 | 00 |

Dr. Samuel Ives.

| 1835. | J | F | | \$ | C. |
|-------|----|---|--------------------------|----|----|
| Jan. | 17 | 3 | To sundries | 11 | 55 |
| Feb. | 2 | 4 | Sundries | 7 | 25 |
| | | | Balance transferred..... | 31 | 86 |
| | | | | 50 | 66 |

Dr. Daniel Jones.

| 1835. | J | F | | \$ | C. |
|-------|----|---|--------------------------|----|----|
| Jan. | 19 | 3 | To sundries | 24 | 60 |
| Feb. | 3 | 5 | Sundries | 7 | 11 |
| | | | Balance transferred..... | 13 | 29 |
| | | | | 45 | 00 |

Dr. James George.

| 1835. | J | F | | \$ | C. |
|-------|----|---|----------------|-----|----|
| Jan. | 1 | 1 | To stock | 200 | 00 |
| | 20 | 3 | Sundries | 4 | 05 |
| Feb. | 4 | 5 | Sundries | 7 | 03 |
| | | | | 211 | 08 |

Dr. John Dole.

| 1835. | J | F | | \$ | C. |
|-------|---|---|------------------|-----|----|
| Jan. | 1 | 1 | To balance | 150 | 00 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|--------------------------|----|----|----|
| March | 9 | To sundries | 8 | 45 | 60 |
| | 11 | Order on John Ames | 8 | 5 | 00 |
| | | | | 50 | 66 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|-----------------------------|----|----|----|
| March | 10 | By order on John Wait | 8 | 30 | 00 |
| | 13 | 1 ton of hay | 8 | 15 | 00 |
| | | | | 45 | 00 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|----|---------------------------|----|-----|----|
| March | 12 | By cash on account | 8 | 10 | 00 |
| | 14 | Sundries | 9 | 10 | 00 |
| | | Balance transferred | | 191 | 00 |
| | | | | 211 | 08 |

Cr.

| 1835. | | | JF | \$ | C. |
|-------|---|----------------|----|-----|----|
| Jan. | 1 | By stock | 1 | 150 | 00 |

BOOK-KEEPING BY DOUBLE ENTRY.

The art of book-keeping by *Double Entry* consists in recording correctly and intelligibly every transaction, in relation to buying and selling each kind of goods employed in trade.

The three principal books used, are the Waste or Day Book, the Journal, and the Leger.

The auxiliary books, are the Cash, Bill, Invoice, Sales, Commission, Letter, Postage, Expense, Receipt, Memorandum books.

THE WASTE, OR DAY BOOK.

For the forms, &c. of this book, see Single Entry.

JOURNAL.

The *Journal* is a fair transcript of all the transactions in the Waste Book.

The art of book-keeping wholly depends on a correct discrimination of Dr. and Cr.

The following rules should be carefully observed.

DEBTOR AND CREDITOR.

Goods bought for ready money are Dr. to cash.

Goods bought on credit are Dr. to the seller.

Goods bought for part money, and part credit, are Dr. to sundries; to cash paid in part, and to the seller for the remainder.

When money is paid, the receiver is Dr., and cash Cr.

NOTE.—When money is paid, it should be specified, whether in part, or in full.

When goods are sold on credit, the *buyer* is Dr. to *goods*.

When goods are sold for cash, *cash* is Dr. to *goods*.

When goods are sold for part cash and part credit, sundries are Dr. to goods to *cash* for the sum received, and the *purchaser* for the rest.

The following *general rule*, if correctly understood, is sufficient for all the purposes of posting.

Whatever is received, as a consideration for goods sold, is Dr.; and whatever is paid for goods received, whether cash, notes, orders, bills, &c., is Cr.

LEGER.

The *Leger* is the merchant's principal book, to which the several transactions, dispersed through the Waste Book, &c. are transferred each to its proper account.

In posting the Leger, the following circumstances should be carefully observed.

On the Dr. side should be written,

1. The date.
2. The Journal folio.
3. Each creditor title.
4. The transaction.
5. The quantity and quality of goods.
6. Leger folio of the creditor.
7. The amount in dollars and cents.

On the creditor side should be written,

1. The date.
2. The Journal folio.
3. Each debtor title.
4. The transaction.
5. The quantity and quality of goods.
6. Leger folio of the debtor.
7. Amount in dollars and cents.

The merchant should arrange his accounts in the Leger according to their importance.

Stock should be first, and cash second.

Boston, January 1, 1835.

| J. F. | | \$ | C. |
|--|--|----------|---------|
| An Inventory of money, goods, debts, &c., be- longing to me, James Hobart, and also of my debts. | | | |
| 1 | I have in ready money..... | \$100.00 | |
| | 34 barrels of flour, at \$5 | 170.00 | |
| | 40 pieces of linen, at \$20 | 800.00 | |
| | 5 cwt. sugar, at \$10..... | 50.00 | |
| | 20 quintals fish, at \$3 | 60.00 | |
| | 8 hhds. molasses, at \$30 | 240.00 | |
| | | <hr/> | 1420 00 |
| " " | | | |
| 1 | I am indebted to Daniel Fox, on account | | |
| | | \$50.00 | |
| | John Chase, on account | 20.00 | |
| | John Jones, " | 36.00 | |
| | | <hr/> | 106 00 |
| 2 | | | |
| 1 | Sold John Dow 10 barrels flour, at \$6 | 60 00 | |
| 3 | | | |
| 1 | Sold for cash 12 barrels of flour, at \$6 | 72 00 | |
| 5 | | | |
| 1 | Sold Daniel Fox 10 pieces of linen, at \$25 . | 250 00 | |
| 6 | | | |
| 1 | Sold John Chase 5 cwt. of sugar, at \$12 ... | 60 00 | |
| 7 | | | |
| 1 | Sold for cash 8 barrels of flour, at \$6.50 | 52 00 | |
| 8 | | | |
| 1 | Bought for cash 10 cwt. of sugar, at \$11 ... | 110 00 | |
| 9 | | | |
| 1 | Sold John Jones 8 cwt. sugar, at \$14 | 112 00 | |
| 10 | | | |
| 1 | Received of John Dow, on account..... | 50 00 | |
| 12 | | | |
| 1 | Sold Daniel Fox 2 cwt. sugar, at \$14 | 28 00 | |
| 13 | | | |
| 2 | Received of Daniel Fox, on account | 200 00 | |
| 14 | | | |
| 2 | Received of John Dow, on account | 10 00 | |
| 15 | | | |
| 2 | Sold John Jones 10 quintals of fish, at \$4 .. | 40 00 | |

Boston, January 16, 1835.

| L. F. | | \$ | C. |
|-------|--|-----------|-------|
| 2 | Shipped in the Patience, John Martin, master, for Hartford, consigned to my factor, Sam- uel Bond, on my account | | |
| | 2 barrels flour | at \$6.00 | |
| | 10 quintals fish, | at 3.75 | |
| | Charges at shipping | 2.00 | 51 50 |
| | 17 | | |
| 2 | Sold John Chase 12 pieces linen, at \$25 ... | 300 | 00 |
| | 19 | | |
| 2 | Received of John Chase, on account | 230 | 00 |
| | 20 | | |
| 2 | Samuel Bond advises me that he has received the goods sent him, and that, having dispos- ed of them, the nett proceeds are | 70 | 00 |
| | 21 | | |
| 2 | Sold John Dow 6 hhds. molasses, at \$35 ... | 210 | 00 |
| | 22 | | |
| 2 | Sold John Jones 10 pieces linen, at \$24 ... | 240 | 00 |
| | 23 | | |
| 2 | John Dow paid, on account | 130 | 00 |
| | 26 | | |
| 2 | John Jones paid, on account | 200 | 00 |
| | 27 | | |
| 2 | Paid my book-keeper one month's salary .. | 25 | 00 |

INDEX TO THE LEGER.

| | Fol. | | Fol. |
|----------------------------|------|----------------------|------|
| A | | B | |
| Adventure to Hartford..... | 3 | Balance..... | 3 |
| | | Bond Samuel..... | 3 |
| C | | D | |
| Cash | 1 | Dow John..... | 3 |
| Chase John..... | 2 | | |
| F | | J | |
| Fox Daniel..... | 2 | Jones John | 3 |
| Fish | 2 | L | |
| Flour | 1 | Linen.... | 1 |
| M | | P | |
| Molasses..... | 2 | Profit and Loss..... | 3 |
| S | | | |
| Stock..... | 1 | Sugar | |

Boston, January 1, 1835.

| L. F. | L. F. | | \$ | C. |
|-------|-------|---------------------------------|----------|---------|
| Dr. | Cr. | | | |
| | 1 | Sundries Dr. to stock, | | |
| 1 | | Cash..... | \$100.00 | |
| 1 | | Flour, 34 barrels, at | 5.00 | |
| 1 | | Linen, 40 pieces, at..... | 20.00 | |
| 2 | | Sugar, 5 cwt., at | 10.00 | |
| 2 | | Fish, 20 quintals, at | 3.00 | |
| 2 | | Molasses, 8 hhds., at | 30.00 | |
| | | | <hr/> | 1420 00 |
| | | “ | | |
| 1 | | Stock Dr. to sundries, | | |
| 2 | | To Daniel Fox, on account | \$50.00 | |
| 2 | | John Chase | 20.00 | |
| | | John Jones | 36.00 | |
| | | | <hr/> | 106 00 |
| | 2 | | | |
| 3 | 1 | John Dow Dr. to flour, | | |
| | | For 10 barrels, at \$6 | 60 00 | |
| | 3 | | | |
| 1 | 1 | Cash Dr. to flour, | | |
| | | For 12 barrels, at \$6..... | 72 00 | |
| | 5 | | | |
| 2 | 1 | Daniel Fox Dr. to linen, | | |
| | | For 10 pieces, at \$25 | 250 00 | |
| | 6 | | | |
| 2 | 2 | John Chase Dr. to sugar, | | |
| | | For 5 cwt., at \$12 | 60 00 | |
| | 7 | | | |
| 1 | 1 | Cash Dr. to flour, | | |
| | | For 8 barrels, at \$6.50 | 52 00 | |
| | 8 | | | |
| 2 | 1 | Sugar Dr. to cash, | | |
| | | For 10 cwt., at \$11..... | 110 00 | |
| | 9 | | | |
| 3 | 2 | John Jones Dr to sugar, | | |
| | | For 8 cwt., at \$14 | 112 00 | |
| | 10 | | | |
| 1 | 3 | Cash Dr. to John Dow, | | |
| | | Received, on account..... | 50 00 | |
| | 12 | | | |
| 2 | 2 | Daniel Fox Dr. to sugar, | | |
| | | For 2 cwt., at \$14 | 28 00 | |

Boston, January 13, 1835.

| L. | F. | L. | F. | \$ | C. |
|----|----|---|----|--------|-------|
| 1 | 2 | Cash Dr. to Daniel Fox, Received, on account..... | 14 | 200 | 00 |
| 1 | 3 | Cash Dr. to John Dow, Received, on account..... | 15 | 10 | 00 |
| 3 | 2 | John Jones Dr. to fish, For 10 quintals, at \$4 | 16 | 40 | 00 |
| 3 | | Adventure to Hartford Dr. to sundries, For flour, 2 barrels, at | | \$6.00 | |
| | 2 | Fish, 10 quintals, at | | 3.75 | |
| | 1 | Charges | | 2.00 | 51 50 |
| 2 | 1 | John Chase Dr. to linen, For 12 pieces, at \$25 | 17 | 300 | 00 |
| 1 | 2 | Cash Dr. to John Chase, Received, on account | 19 | 230 | 00 |
| 3 | 3 | Samuel Bond Dr. to adventure to Hartford, For nett proceeds consigned to him | 20 | 70 | 00 |
| 3 | 2 | John Dow Dr. to molasses, For 6 hhds., at \$35 | 21 | 210 | 00 |
| 3 | 1 | John Jones Dr. to linen, For 10 pieces, at \$24 | 22 | 240 | 00 |
| 1 | 3 | Cash Dr. to John Dow, Received, on account..... | 23 | 130 | 00 |
| 1 | 3 | Cash Dr. to John Jones, Received, on account..... | 26 | 200 | 00 |
| 3 | 1 | Profit and loss Dr. to cash, For my book-keeper's salary | 27 | 25 | 00 |

Dr.

Stock.

| 1835. | | JF | | Cr. | L | F | \$ | C. |
|-------|----|----|-----------------------------|-----|---|---|-------------|-----------|
| | | | | | | | | |
| Jan. | 1 | 1 | To sundries | | | | 106 | 00 |
| | 31 | | Balance per nett stock..... | 3 | | | 1581 | 00 |
| | | | | | | | <u>1687</u> | <u>00</u> |

Dr.

Cash.

| 1835. | | JF | | Cr. | L | F | \$ | C. |
|-------|----|----|------------------|-----|---|---|-------------|-----------|
| | | | | | | | | |
| Jan. | 1 | 1 | To stock | 1 | | | 100 | 00 |
| | 3 | 1 | Flour | 1 | | | 72 | 00 |
| | 7 | 1 | Flour | 1 | | | 52 | 00 |
| | 10 | 1 | John Dow | 3 | | | 50 | 00 |
| | 13 | 2 | Daniel Fox | 2 | | | 200 | 00 |
| | 14 | 2 | John Dow | 3 | | | 10 | 00 |
| | 19 | 2 | John Chase | 2 | | | 230 | 00 |
| | 23 | 2 | John Dow | 3 | | | 130 | 00 |
| | 26 | 2 | John Jones | 3 | | | 200 | 00 |
| | | | | | | | <u>1044</u> | <u>00</u> |

Dr.

Flour.

| 1835. | | JF | | Bhls. | Cr. | L | F | \$ | C. |
|-------|----|----|-----------------------|-----------|-----|---|---|------------|-----------|
| | | | | | | | | | |
| Jan. | 1 | 1 | To stock, at | 34 | 1 | | | 170 | 00 |
| | 31 | 1 | Profit and loss | | 3 | | | 36 | 00 |
| | | | | <u>34</u> | | | | <u>206</u> | <u>00</u> |

Dr.

Linen.

| 1835. | | JF | | ps. | Cr. | L | F | \$ | C. |
|-------|----|----|-----------------------|-----------|-----|---|---|------------|-----------|
| | | | | | | | | | |
| Jan. | 1 | 1 | To stock, at | 40 | 1 | | | 800 | 00 |
| | 31 | 4 | Profit and loss | | 3 | | | 150 | 00 |
| | | | | <u>40</u> | | | | <u>950</u> | <u>00</u> |

Contra.

Cr.

| 1835. | | JF | | Cr. | \$ | C. |
|-------|----|----|-----------------------|-----|-------------|-----------|
| Jan. | | | | L F | | |
| | 1 | 1 | By sundries..... | | 1420 | 00 |
| | 31 | | Profit and loss | 3 | 267 | 00 |
| | | | | | <u>1687</u> | <u>00</u> |

Contra.

Cr.

| 1835. | | JF | | Cr. | \$ | C. |
|-------|-----|----|-----------------------------|-----|-------------|-----------|
| Jan. | | | | L F | | |
| | 81 | | By sugar | 2 | 110 | 00 |
| | 162 | | Adventure to Hartford | 3 | 2 | 00 |
| | 272 | | Cash | 3 | 25 | 00 |
| | 312 | | Balance remaining | 3 | 907 | 00 |
| | | | | | <u>1044</u> | <u>00</u> |

Contra.

Cr.

| 1835. | | JF | | Bbls. | Cr. | \$ | C. |
|-------|----|----|--------------------------------|-----------|-----|------------|-----------|
| Jan. | | | | | L F | | |
| | 2 | 1 | By John Dow, at \$6.00 | 10 | 3 | 60 | 00 |
| | 3 | 1 | By cash, at 6.00 | 12 | 1 | 72 | 00 |
| | 7 | 1 | By cash, at 6.50 | 8 | 1 | 52 | 00 |
| | 16 | 2 | Adventure to Hartford, at 6.00 | 2 | 3 | 12 | 00 |
| | 31 | | Balance, at 5.00 | 2 | 3 | 10 | 00 |
| | | | | <u>34</u> | | <u>206</u> | <u>00</u> |

Contra.

Cr.

| 1835. | | JF | | Ps. | Dr. | \$ | C. |
|-------|----|----|--------------------------------|-----------|-----|------------|-----------|
| Jan. | | | | | L F | | |
| | 5 | 1 | By Daniel Fox, at..... \$25.00 | 10 | 2 | 250 | 00 |
| | 17 | 2 | John Chase, at..... 25.00 | 12 | 2 | 300 | 00 |
| | 22 | 2 | John Jones, at 24.00 | 10 | 3 | 249 | 00 |
| | 31 | | Balance..... 20.00 | 8 | 3 | 160 | 00 |
| | | | | <u>40</u> | | <u>950</u> | <u>00</u> |

| Contra. | | | | Cr. | | | |
|---------|----|----|--------------------------------|------|------------|-----|----|
| 1835. | | JF | | Cwt. | Dr. L F | \$ | C. |
| Jan. | 6 | 1 | By John Chase, at\$12.00 | 5 | 2 | 60 | 00 |
| | 9 | 1 | John Jones, at. 14.00 | 8 | 3 | 112 | 00 |
| | 12 | 1 | Daniel Fox, at 14.00 | 2 | 2 | 28 | 00 |
| | | | | 15 | | 200 | 00 |

| Contra. | | | | Cr. | | | |
|---------|----|----|-------------------------------|--------|------------|----|----|
| 1835. | | JF | | Quint. | Dr. L F | \$ | C. |
| Jan. | 15 | 2 | By John Jones, at\$4.00 | 10 | 3 | 40 | 00 |
| | | 2 | Adventure to Hartford... 3.75 | 10 | 3 | 37 | 50 |
| | | | | 20 | | 77 | 50 |

| Contra. | | | | Cr. | | | |
|---------|----|----|-----------------------------|-------|------------|-----|----|
| 1835. | | JF | | Hhds. | Dr. L F | \$ | C. |
| Jan. | 21 | 2 | By John Dow, at.....\$35.00 | 6 | 3 | 210 | 00 |
| | 31 | 2 | Balance..... 30.00 | 2 | 4 | 60 | 00 |
| | | | | 8 | | 270 | 00 |

| Contra. | | | | Cr. | | | |
|---------|----|---|----------------|-----|------------|-----|----|
| 1835. | | J | | | Dr. L F | \$ | C. |
| Jan. | 1 | 1 | By stock | | 1 | 50 | 00 |
| | 13 | 2 | Cash | | 1 | 200 | 00 |
| | 31 | 2 | Balance | | 4 | 28 | 00 |
| | | | | | | 278 | 00 |

| Contra. | | | | Cr. | | | |
|---------|----|----|----------------|-----|------------|-----|----|
| 1835. | | JF | | | Dr. L F | \$ | C. |
| Jan. | 1 | 1 | By stock | | 1 | 20 | 00 |
| | 19 | 2 | By cash..... | | 1 | 230 | 00 |
| | 31 | 2 | Balance | | 4 | 110 | 00 |
| | | | | | | 360 | 00 |

| Contra. | | | | Cr. | | |
|---------|----|----|----------------|-----|-----|----|
| 1835. | | JF | | Dr. | \$ | C. |
| Jan. | 1 | 1 | By stock | L F | | |
| | 26 | 2 | Cash | 1 | 36 | 00 |
| | 31 | | Balance | 1 | 200 | 00 |
| | | | | 4 | 156 | 00 |
| | | | | | | - |
| | | | | | 392 | 00 |

| Contra. | | | | Cr. | | |
|---------|----|----|---------------|-----|-----|----|
| 1835. | | JF | | Dr. | \$ | C. |
| Jan. | 10 | 1 | By cash | L F | | |
| | 14 | 2 | Cash | 1 | 50 | 00 |
| | 23 | 2 | Cash | 1 | 10 | 00 |
| | 31 | | Balance | 1 | 130 | 00 |
| | | | | 4 | 80 | 00 |
| | | | | | | - |
| | | | | | 270 | 00 |

| Contra. | | | | Cr. | | |
|---------|----|----|----------------------|-----|----|----|
| 1835. | | JF | | Dr. | \$ | C. |
| Jan. | 20 | 2 | By Samuel Bond | L F | | |
| | | | | 3 | 70 | 00 |

| Contra. | | | | Cr. | | |
|---------|----|----|------------------|-----|----|----|
| 1835. | | JF | | Dr. | \$ | C. |
| Jan. | 31 | 2 | By Balance | L F | | |
| | | | | 4 | 70 | 00 |

| Contra. | | | | Cr. | | |
|---------|---|----|-----------------------------|-----|-----|----|
| 1835. | | JF | | Dr. | \$ | C. |
| Jan. | 1 | | By flour | L F | | |
| | | | Linen | 1 | 36 | 00 |
| | | | Sugar | 1 | 150 | 00 |
| | | | Fish | 2 | 40 | 00 |
| | | | Molasses | 2 | 17 | 50 |
| | | | Adventure to Hartford | 2 | 30 | 00 |
| | | | | 3 | 18 | 50 |
| | | | | | | - |
| | | | | | 292 | 00 |

Dr.

Balance.

| 1835. Jan. | 31 | JF | | Cr. L F | \$ | C. |
|---------------|----|----|------------------|------------|------|----|
| | | | | | | |
| | | | To Cash | 1 | 907 | 00 |
| | | | Flour | 1 | 10 | 00 |
| | | | Linen..... | 1 | 160 | 00 |
| | | | Molasses | 2 | 60 | 00 |
| | | | Daniel Fox | 2 | 28 | 00 |
| | | | John Chase | 2 | 110 | 00 |
| | | | John Jones | 3 | 156 | 00 |
| | | | John Dow | 3 | 80 | 00 |
| | | | Samuel Bond..... | 3 | 70 | 00 |
| | | | | | 1581 | 00 |

General Trial Balance.

| Titles of Accounts. | LF | Dr. | Cr. | Dr. | Cr. |
|-----------------------|----|-----------|-----------|-----------|-----------|
| | | | | | |
| Stock..... | 1 | \$ 106.00 | \$1420.00 | \$ | \$1314.00 |
| Cash | 1 | 1044.00 | 137.00 | 907.00 | |
| Flour | 1 | 170.00 | 196.00 | | 16.00 |
| Linen | 1 | 800.00 | 790.00 | 10.00 | |
| Sugar | 2 | 160.00 | 200.00 | | 40.00 |
| Fish..... | 2 | 60.00 | 77.50 | | 17.50 |
| Molasses | 2 | 240.00 | 210.00 | 30.00 | |
| D. Fox | 2 | 278.00 | 250.00 | 18.00 | |
| J. Chase | 2 | 360.00 | 250.00 | 110.00 | |
| J. Jones..... | 3 | 392.00 | 236.00 | 156.00 | |
| J. Dow | 3 | 270.00 | 190.00 | | |
| Adventure to Hartford | 3 | 51.50 | 70.00 | | 18.50 |
| S. Bond | 3 | 70.00 | 00.00 | 70.00 | |
| Profit and Loss | 3 | 25.00 | 00.00 | 25.00 | |
| Proof. | | \$4026.50 | \$4026.50 | \$1406.00 | \$1406.00 |

| Contra. | | | | Cr. | | |
|---------|----|----|-----------------------------------|------------|------|----|
| 1835. | | JF | | Dr. L F | \$ | C. |
| Jan. | 31 | | Stock for nett of my estate | | 1581 | 00 |

END OF BOOK-KEEPING.

ERRATA.

Page 30, Question 27, the answer should be 2053; Q. 34, A. 59784. P. 35, Q. 7, A. 15324. P. 36, Q. 21, A. 29957. P. 54, Q. 1, A. $8\frac{1}{2}$ d. P. 55, Q. 11, A. 487in.; Q. 16, A. 249-56m., Q. 21, A. 6a. 2r. 32p. P. 56, Q. 25, A. 13grs.; Q. 27, A. 56cts. P. 60, Q. 7, A. 22560gr. P. 61. Q. 26, A. feet. P. 63, Q. 28, A. 790p. P. 73, Q. 11, insert 1cwt.; Q. 19, A. 209 hhd., 55gals. P. 74, Q. 20, A. 35t.; Q. 22, A. 118bu. P. 75, Q. 7, A. 5T., 13cwt., 1qr., 15lbs. P. 107, Q. 13, A. $\frac{2}{17}$. P. 108, Q. 10, A. $2\frac{83}{111}$ T. P. 111, Q. 4, A. $\frac{118}{148}$. P. 118, Q. 7, A. $\frac{87}{185}$. P. 121, Q. 11, A. $15\frac{1}{3}$ p. P. 122, Q. 21, A. $527\frac{1}{2}$ ft. P. 161, error in operation. P. 165, Q. 1, $\frac{1}{2}$ A, 107.52; Q. 2, A. 157.25; Q. 5, A. 2750. P. 191, Q. 5, A. C's cloth per yard, \$1.50. P. 194, Q. 7, A. A's \$300.51 $\frac{1}{3}$, P's \$300.51 $\frac{1}{3}$, C's 440.76 $\frac{1}{3}$. P. 196, Q. 15, A. \$195.51. P. 181, Q. 44, A. 20 $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$. P. 165, Q. 3, A. \$1380. P. 188, Q. 5, A. 36 $\frac{1}{3}$. Ps. 335 and 336, on the right side, Cr. and Dr. should be reversed. This error was not noticed until a portion of the edition was printed, a part being correct.

MERCANTILE FORMS.

General Receipt.

Boston, Nov. 7, 1835. Received of John Jacobs, ten dollars,
in full of all accounts. JOHN JAY.

Receipt for Money on Account.

Boston, Sept. 25, 1835. Received of Samuel Eaton, twenty dollars, on account. SAMUEL SNOW.

Receipt for an Indorsement on a Note.

Salem, Nov. 1, 1835. Received of William Jones, seventy-five dollars, which is indorsed on his note, of June 7, 1834, for three hundred and fifty dollars. PHILIP QUARLES.

Form for Notes, see page 153.

Bill of Exchange, see page 257.

An Order for Merchandise.

Mr. Alfred Perkins,

Pay the bearer, fifty dollars, in merchandise,
from your store, and charge your obt. servant,

Lowell, May 15th, 1835. THOMAS FREEMAN.

An Order for Money.

Messrs. Stanford & Davis,

Pay to the order of J. L. Fairbanks, thirty-five dollars and seventy cents, and this shall be your receipt for the same. JOHN MARSH.

Boston, Sept. 10th, 1835.

NOTE.—A receipt given in full of *all accounts* cuts off accounts only; but a receipt given in full of *all demands*, cuts off all notes and accounts. An order, when paid, should be receipted on the back of the same, by the person to whom it is made payable, or his attorney; but when it is made payable to *A. B., or bearer*, it may be receipted by any one who presents it for payment.

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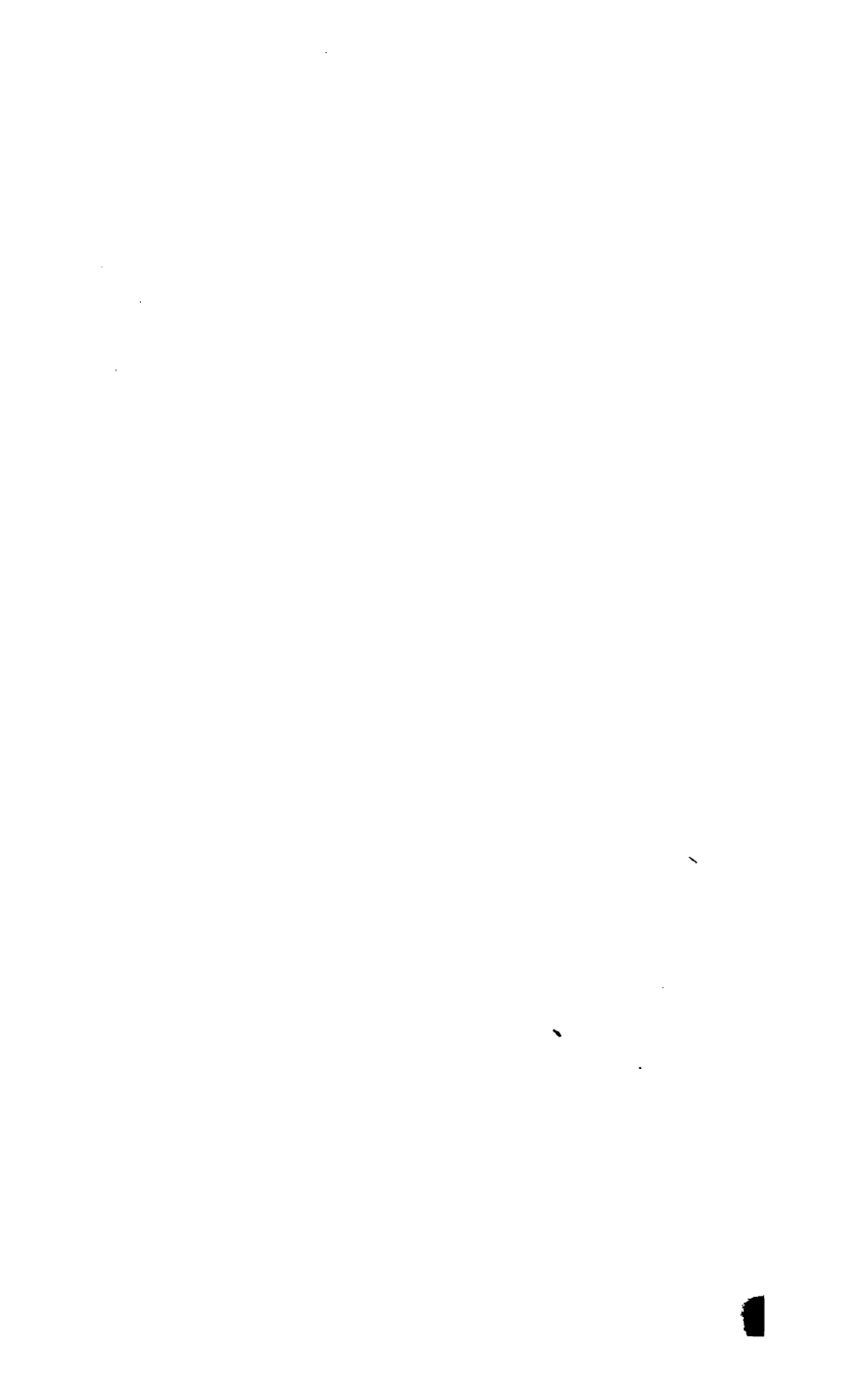
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~~SEP 10 1940~~

the first of these is the fact that the system is not in equilibrium with the environment.

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